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FORESTRY ABSTRACTS

VOLUME I NUMBER I

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INTRODUCTION

THIS first issue of our abstract periodical has been prepared in circumstances of some difficulty and we hope that any shortcomings in it will be leniently regarded. Though the Bureau has been in existence as a nucleus organization since last October, there has been unavoidable delay in the appointment of its executive head who has, however, taken up his duties since this went to press. The technique of abstracting forestry literature presents a number of problems, to all of which one could hardly expect to find satisfactory solutions at the first attempt, and their treatment has been necessarily experimental; though the established practice of the other bureaux of the *I.A.B.* organization has been a valuable guide in determining questions of form and substance.

Most of the papers abstracted are selected from the literature of 1938, but a few are of earlier date: our next issue will begin to deal with material published in 1939. The annual reports included in the section devoted to this class of publication pertain to 1937 and 1937–8, but it has not been possible to deal comprehensively with the reports of this period. It will be appreciated that it is impracticable to summarize annual reports in this journal; all that can be done is to note points in them that appear to be interesting or suggestive to readers at large, and the selection of these will always be a matter of individual opinion.

It may be noted that the *Current Monthly Record* of incoming literature is to be continued for the present in the interests of those who find it useful to have lists of material as it appears; but it may be necessary to repeat in *Forestry Abstracts* some of the titles included in the *C.M.R.* in the case of papers that are of importance but for one reason or another unsuitable for abstracting.

Attention is invited to the notice on the inside back cover regarding our loan collection of reprints.

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FORESTRY ABSTRACTS

VOLUME I 1939 NUMBER I

THE CHANGING SHAPE OF FORESTRY

THOSE who have been interested in the study of trends in forestry will have noticed during the past few years a distinct change in the outlook of foresters and forestry organizations in many parts of the world. Largely as a result of the growing realization and experience of the evils consequent on misuse of land, there has been a gradual shifting of emphasis from 'production forestry' to 'protection forestry'; and foresters are coming to regard their work less as an isolated activity, carried on in reserves set apart for the purpose, than as one of several facets of the complex problem of land use. An outcome of this movement has been a widespread urge towards the acquisition of deeper knowledge of the sciences common to forestry and other relatively extensive forms of land use, and fundamental to the study of soil, vegetation, and climate. The following extract, which we are permitted to reproduce from a Parliamentary White Paper on the Colonial Empire during the year ended 31st March 1939,[1] is illustrative of the movement, and interesting for the outline it gives of the present trend of forest policy in the British Colonies:

FORESTRY

'It is commonly supposed that forestry is concerned mainly with the growing of timber, but in the Colonial Empire the activities covered by the term extend over a much wider field. As is made clear in Lord Hailey's "African Survey", the importance that attaches in Africa to a forestry régime does not lie only in the extent to which timber can be exploited for export or for home consumption: in many cases forests are valuable primarily for the direct protection that they afford to the water supply, or for their influence on climatic conditions, both vital to the methods of livelihood of the African communities.

'Over vast areas, in Africa and elsewhere, the maintenance of forest or some other form of vegetal cover is the only cheap and practical means of preserving the soil from erosion and maintaining its fertility; and the systematic use of vegetation for this protective purpose is a function of the forestry departments that is steadily extending.

'The influence that forests exert on climatic environment, by providing shelter from desiccating winds and conserving soil moisture and atmospheric humidity, is of great importance in growing certain economic crops. It is now recognized, for example, that the health and productivity of cocoa plantations in West Africa depend largely on the maintenance of environmental conditions approaching those of tropical evergreen forest; and that wholesale clearing of forest to grow more cocoa may seriously affect production from existing plantations. The problem calls for closer investigation by experts in climatology and plant ecology, and steps are being taken to supply this need.

'The studies carried on by forest departments have demonstrated the value of vegetation surveys in determining the uses to which land should be put. Natural vegetation is normally a good index of soil fertility, and the ease and rapidity with which vegetation types can be mapped is of significance in rural planning. The usefulness of the method will be greatly enhanced as air surveys are extended, and meanwhile it is important that the different types of vegetation should be studied and classified on the ground with a view to their identification from the air.

'In these circumstances, forestry departments are becoming more and more involved in the study of general problems of rural development and land use, and contacts between them and other departments engaged on similar work have been strengthened. There is room, however, for more co-operation, and the example set by certain dependencies in organizing a concerted attack on rural problems by the departments concerned with the use of the land should be helpful in promoting this.

'The policy of encouraging native administrations in the African dependencies to take an interest

[1] *The Colonial Empire. Statement relating to the Period 1st April 1938, to 31st March 1939, to accompany the Estimates for Colonial and Middle Eastern Services, 1939.* Cmd. 6023. H.M. Stationery Office. 1939.

in the preservation of forests and to establish timber plantations and fuel and fodder reserves is having good results, particularly in regions where supplies of forest produce are inadequate.

'A movement is on foot to promote the more intensive use by local enterprise of forests capable of supplying raw material for sawmills and wood-working industries. An expert from the Forest Service in Malaya, where this movement has been highly successful, recently completed a study of the possibilities of such development in West and East Africa, and considers them promising, provided that the requisite technical advice can be supplied. Owing to high costs of production, sawn timber of the utility class has hitherto been a luxury beyond the reach of the less well-to-do sections of the population; but it is thought that the supply of cheap material, turned out by methods akin to mass production, should result in a substantial broadening of the market and a consequent improvement in standards of housing and comfort for the poorer classes. Development on these lines should in time supersede the present widespread practice of restricting exploitation to relatively small quantities of a few valuable timbers and leaving large quantities of so-called "secondary" timbers untouched.

'The Colonial Forest Resources Development Department, an organization set up in 1935, has continued the work initiated in the past by the Empire Marketing Board with the assistance of the specialized services of the Forest Products Research Laboratory, Princes Risborough. The Forest Economist repeated his visit to the West Indies where he was put at the service of a private firm which contemplated the establishment of a local timber industry. Commercial tests and investigations on Colonial timbers have been carried out and market promotion actively pursued by the Department. Advantage has been taken of exhibitions for showing those timbers of which commercial supplies are available from the Colonies, and information has been prepared in suitable form for wide distribution at the World's Fair in New York.'

NOTES FROM ANNUAL REPORTS

Reports examined include: *Assam*: Progress Report of the Forest Administration for 1937–8. *Australia*: Twelfth Annual Report of the Council for Scientific and Industrial Research, 1937–8. *Brunei*: Report on Forest Administration for the year 1938. *Burma*: Report on Forest Administration for the year ending 31st March 1938. *Canada*: Report of Lands, Parks, and Forests Branch for the year ended 31st March 1938. *Central Provinces and Berar*: Administration Report on the Forest Department for the year ending 31st March 1938. *Gold Coast*: Annual Report on the Forestry Department, 1937–8. *Great Britain*: Eighteenth Annual Report of the Forestry Commissioners for the year ending 30th September 1937. *India*: Annual Report on Forest Research, 1937–8. Part I. The Forest Research Institute. *Orissa*: Annual Progress Report on Forest Administration, 1937–8. *New Brunswick*: 102nd Annual Report of the Department of Lands and Mines for the year ended 31st October 1938. *New Zealand*: Annual Report of the Director of Forestry for the year ended 31st March 1938. *North-West Frontier Province*: Progress Report on Forest Administration for the year ending 31st March 1938. *Queensland*: Report of the Director of Forests for 1937–8. *Saskatchewan*: Annual Report of the Director of Forests for the year ending 30th April 1938. *South Australia*: Annual Report of the Woods and Forests Department for the year ended 30th June 1938. *United Provinces*: Annual Progress Report of the Forest Administration, 1937–8. *Western Australia*: Report on the Operations of the Forest Department for the year ended 30th June 1938.

The numbers in brackets indicate the pages of the reports to which the annotations refer.

GENERAL FORESTRY

Great Britain. Survey of land and negotiations for acquisition of land under the scheme of afforestation and forest workers' holdings in the Special Areas of England and Wales took place over 568,000 acres within a 15-mile radius of the Special Areas. Some 27 per cent. of the owners agreed, 40 per cent. were willing to consider, and the remainder were unwilling (4). Steps were taken to increase the supply of the necessary plants (5). The maintenance in a productive state of private woodlands is a major consideration in Forest Policy. Five courses of instruction arranged for foremen foresters on private estates were attended by 54 woodmen. A conference on Private Forestry, with representatives of all the interests concerned, advocated the institution of an advisory service to help the woodland owner (13). The movement for the formation of National Parks is making good

progress (15). An organized census of woodlands was commenced in January 1938, the last having been taken in 1924 (17).

India, F.R.I., Dehra Dun. A Research Demonstration course for officers from the Provinces was started in 1937 (2).

FOREST INFLUENCES

New Zealand. Recent serious floods, landslides, &c., in Northern Island are doubtfully attributable wholly to destruction of forest cover: the earthquake of 1931 may have been an important cause of the landslides (9).

United Provinces. Flooding of certain rivers is attributed to denudation in the Himalayas (7).

South Australia. From the standpoint of soil conservation it would be an advantage if all Crown lands not required for other purposes were placed under forest management (3). The seriousness of the damage from water and wind erosion in the State, and the need for protecting natural vegetation in regions with less than 25 in. rainfall, where afforestation is uneconomic, are discussed (4).

SILVICULTURE

Assam. Successful natural regeneration is recorded of Sal in Kamrup Division and of *Dipterocarpus macrocarpus–Mesua ferrea* evergreen forest in Upper Assam (5).

Canada. At Petawawa, as a result of experiences in 1937, the season of sowing of conifers has been changed from spring to autumn. Preparation and propagation of Poplar cuttings and hybridization of Poplars have received attention (111–12). Phenological observations at the Acadian Experiment Station showed the growing season of Balsam Fir, culminating about the third week of June, to be from one to two weeks longer than that of Spruce, which culminates about the second week in July (113).

Central Provinces and Berar. Variations in quality and composition of the forests, and in climatic and economic conditions, are so great that standard felling rules must be made more flexible (12). Clear felling of certain Sal forests results in frost damage (13). Teak planting on clear-felled areas costs Rs. 5–10 per acre. Two methods followed consist of 'stump' planting for larger plantations at a distance from the nursery, and 'dona' planting, using 3 months old entire transplants raised from seed in leaf-cups (*donas*); the latter being suitable for small plantations close to the nursery site, also for tender species other than Teak.

Brunei. In a dense natural crop of *Dryobalanops rappa* the commercial demand for poles was insufficient to secure the degree of thinning required, and the additional thinning necessary was carried out by poison-girdling at a cost of 2*s.* 5*d.* per acre.

Burma. Planting policy aims at supply of internal demand for Teak, Pyinkado, and firewood, and for the quinquennium 1938–43 new planting is to be limited to an annual area of 1,500 acres, mostly for village supply (20). The area artificially regenerated was 2,112 acres, of which 63 per cent. was Teak, 27 per cent. Pyinkado, and 10 per cent. Cutch (21). Further experiments with Teak stumps confirmed observations of the last two years that the faster growth of plants from stumps relative to that of direct sown seed or transplants disappeared in the third year of life (22).

Great Britain. Work on raising Poplars has shown the great importance of the right type of nursery soil. In nurseries in eastern England fen soil has grown Poplar of exceptionally fine quality (43).

India, F.R.I., Dehra Dun. Marked differences have been found in the frost hardiness of Teak from different parts of India and Burma (2). A histological study of Sal mycorrhiza is being undertaken (4). Experiments were continued on root competition of Sal and other species (13). Storage of stumps before planting (16). A successful 6-year plantation of *Araucaria cunninghamii* (21). *Cassia tora* proved successful as a green manure in nursery beds (22).

North-West Frontier Province. In the Silver Fir forests in Upper Siran natural seedlings of Fir have appeared in nearly all the burnt patches prepared for the sowing of Deodar (*Cedrus deodara*) (9). The system of sowing Deodar on burnt patches also continues to give remarkable results in the Blue Pine regeneration areas in Upper Siran Range, and the crop after the first seeding felling is likely to contain 50 per cent. of Deodar. Surplus plants transplanted from the patches show 70–75 per cent. of success (21).

Queensland. Increased appropriations have enabled extension of the area of plantations, and of natural forest under silvicultural treatment; also of firebreaks and forest management generally. Early pruning, with subsequent thinning, is needed if the plantations are to yield quality wood (15). 2,256 acres were planted during the year (16). At Beerwah 135 lb. of *Pinus taeda* and 18 lb. of *P. caribaea* seed were collected from selected plantation trees. Local seed gives more vigorous stock than imported (17).

South Australia. Plantations of *Pinus radiata* that suffered serious deformation in early years from 'die-back' are now showing natural regeneration which develops to log size without any sign of this trouble (5).

United Provinces. Natural regeneration of Sal has been successful over large areas in the sub-montane regions (9). Regeneration by *taungya* is also extending (10), and in Gorakhpur, Sal seedling regeneration in *taungyas* is frost-hardy where adjacent coppice suffers severely (7).

EXTRACTION, UTILIZATION, AND MARKETING

Australia. *C.S.I.R.* The difficulty of keeping wet timber free from fungus attack while awaiting test has been overcome by erection of a 7-ton cold storage freezing plant (48). After various trials, an electrical moisture meter is now practically ready for public sale: it will function as an alarm which can be set to indicate boards above or below a chosen moisture content (51). There has been improvement in kiln-drying practice, 479 kilns being now in operation: an increase of 51 since the end of June 1937. Considerable work on steam bending was done during the year (53). Tests on 300 trees were made, in conjunction with the Commonwealth Forestry Bureau, to arrive at the relation between rate of growth and mechanical properties of Alpine Ash (*E. gigantea*) (54). A co-operative scheme provides for the distribution of mounted sections of timbers, photomicrographs, &c. Investigations continue on the causes of brittleness, and on compression wood and tension wood (55). Sodium fluosilicate in relatively low concentrations is effective in preventing *Lyctus* attack on sapwood otherwise liable to it; but its use is attended by serious industrial hazard (57).

Burma. Arrangements were made for supply and passing of 33,500 *Xylia dolabriformis* sleepers for export to India, and 3,800 tons of Teak squares were graded for the Indian Railways under the Seaman-Limaye rules (24).

Canada. A report on laboratory service tests made at Ottawa of the value as a wood preservative of sodium fluoride, alone and in mixtures, is summarized (130). Tests on the variation in density of the wood of common pulpwoods indicate the possibility of predicting the average density for each type of stand from measurement of the rate of growth of the trees. Density being a good indication of pulp yield, this offers a simple method of planning a mill's annual cut (134).

Great Britain. Peeled pit-props from wherever suitable thinnings are available are gradually establishing an assured trade; and, provided care is taken to adhere to specifications, home-grown props are evidently just as good as those imported. The Commissioners continue largely to finance the National Home Grown Timber Council, which published the results of an investigation into the production of pit-props on a commercial basis (10–11).

Gold Coast. Creosoted Affina (*Strombosia pustulata*) is being tried for telegraph poles (9).

India, F.R.I., Dehra Dun. A new Timber Development Section has been set up to promote contact between the Institute and the timber industry (2). Research on pulping of various woods, grasses, and bamboos is described (7, 64). Instances are given of the commercial importance of expert identifications of wood (41). Tests of the suitability of Palmyra palm for transmission poles showed that, though poles of this species are practically hollow circular tapering cylinders, they are equal in strength to Sal poles of similar outside dimensions (47). A study of the variation of strength properties of Sal from important producing areas in India has been started (48). Efforts continue to design a simple and inexpensive 'furnace' kiln (52). An open tank method was devised for treating certain types of wood with Ascu (58). It is hoped that a cheap fire-retardant paint has been evolved (59).

New Zealand. In the interests of silviculture, substitution is being aimed at, wherever possible, of sale of extracted logs for sale of standing timber (3–5). Establishment of State-owned sawmills and wood-using industries and preservation plants is considered imperative for demonstrating the efficient use of widely varying raw material to private enterprise, which is backward in this field (3, 6). Provision of wooden houses for forest labour (6). The export butter-box pool scheme is dis-

cussed (13). Tractor logging is proving increasingly useful for selective cutting. Stress is laid on the importance of mechanization at every stage of production in view of high labour costs. High-speed log frame-saws prove efficient (14). Sap-stain is a serious trouble with exotic Pine timbers (15).

North-West Frontier Province. The difficulties are discussed of marketing *Dalbergia sissoo* from the banks of the Lower Swat Canal, owing to the large amount of defective material. Sample logs tested at Dehra Dun gave admirable plywood with no difficulty in conversion or otherwise (26).

Orissa. A new long-term lease is to be given of certain bamboo areas to a paper-making concern (13).

Queensland. A complete census of the sawmill industry, giving location, capacity, and cut of each plant, was made for the first time under the Sawmills Licensing Act. On 30th June 1937 there were 586 registered sawmills and 14 ply and veneer mills (3).

South Australia. Clear felled stands of 25-year *Pinus radiata*, unpruned and unthinned, gave a net return per acre on logging and milling of £150, and a saw log yield of 6,520 c.ft. (3). Commercial pulping tests of the same species carried out in Europe gave good results (3, 10). A new departmental case board mill, designed to cut small logs of 3½ to 6½ in. diam., started up during the year (8).

United Provinces. Progress is recorded in match, bobbin, and packing case industries (43–4). Manufacture of wall boards is envisaged (49).

Western Australia. Mill studies show a recovery from Jarrah logs ranging from 22 to 42 per cent., and averaging 33 per cent. of the full volume (18).

MINOR PRODUCE

Brunei. Getah pulai, the latex of a species of *Alstonia*, was collected experimentally as a possible substitute for Jelutong in the manufacture of chewing gum.

United Provinces. Plantations of Baib grass (used for paper making) are proving successful (11), and Ulla grass is being experimented with both for ordinary paper (47) and, mixed with Chir Pine, for kraft paper (49).

Western Australia. Depression prevails in the Sandalwood trade due to the Sino-Japanese war. There was increased production of tanning extract from Wandoo (*Eucalyptus redunca* var. *elata*) (9).

PROTECTION

Canada. It is estimated that 15 per cent. of the annual depletion of forests is due to forest fires (110).

India, F.R.I., Dehra Dun. Parasites of Teak defoliators were introduced from Burma to Nilambur (5). The parasitism of *Hypsipyla robusta* was studied by sack-banding *Cedrela toona* trees (33), and an egg parasite was multiplied and released in Mahogany plantations in Madras (35).

New Brunswick. Damage by the European Spruce Sawfly was discussed at a conference, and arrangements were made for the distribution during 1938 of the necessary parasites to check the outbreak (16, 133). A Chair of Forest Entomology is to be established at a Canadian university (17).

Saskatchewan. Use of radio in fire protection (last two pages).

Western Australia. A plan has been adopted for zoning areas under different types of fire protection (15).

ECONOMICS, MANAGEMENT, AND LAND USE

Canada. At the Duck Mountain Station a working plan survey of 765,000 acres of the Riding Mountain National Park was completed in a single season by combining aerial and ground methods (114).

New Zealand. The combination is described of State growing of specialist agricultural crops requiring a high degree of technical supervision, notably tobacco, with the establishment of State exotic forests, to enable labour to be employed all the year round (3, 26). Forest management must be developed rapidly if the State is to realize effectively upon its enormous investments in exotic forests. Long-range planning is essential for development of transport facilities and utilization (5).

South Australia. The softwood forests of the State are an asset of great value in relation to the problem of rural employment, and no other rural industry can compete with them on the class of land that they occupy (3).

United Provinces. A Rural Development Department has been formed to improve grazing and extend village fuel and fodder plantations, with a trained forest officer at its head (33–6).

THE INFLUENCE OF SHELTERBELTS ON THE ECO-CLIMATE OF AREAS ADJACENT TO THEM

THE subject of forest influences is becoming so important nowadays in various parts of the world that the following summarized account of some Russian research on shelterbelt effects should be of interest to many foresters. It is based on the writings listed at the close of this review.

Prior to the establishment in 1931 of the Organization of Research Institutes, some of the problems relating to the influence of shelterbelts on the eco-climate of adjacent land had been studied at several local research stations situated mainly in the steppe and forest-steppe regions of Southern Russia. These studies had special reference to the effect of shelterbelts on the distribution of snow cover, and on the water régime and fertility of the fields lying between them. From 1931 onwards most of the work was taken over by the Research Institutes of Moscow and Kharkov operating through numerous local field stations. These investigations in Russia often suffered from inadequacy of funds and equipment, and from the relative smallness of the technical staff available. Anemometric measurements, for example, had to be confined to the lowest 2 metres of the atmosphere. Nevertheless, it was possible to secure a certain range of reasonably reliable data, the most important of which are outlined below.

One effect of shelterbelts is to diminish considerably the relatively high wind velocity in the dry regions. This is exemplified by data from the Kamenaja Steppe (Voronezh, Southern Russia), which showed that during the period 1918–28 in the protected fields under study the average wind velocity was decreased by about 30 per cent., and the average evaporation by about 35 per cent. as compared with the open steppe. The effect of shelterbelts is most pronounced on the lee side to a distance of 15 to 20 times, and on the windward side to a distance of 5 to 10 times their height. The higher the initial wind velocity in the open steppe, the greater is the retarding effect of shelterbelts. The extent to which the wind régime is modified depends also on the structure of the shelterbelts. Panfilov's investigations in Rostashev (Saratov, Southern Russia) revealed the following relationship between the structure of the shelterbelts examined and the average wind velocity (expressed as a percentage of the initial velocity in the open steppe) within their zone of influence on both leeward and windward sides.

Structure.	*Average wind velocity per cent.*
I. Shelterbelts 'open' throughout their height (partly permeable to wind) . .	88
II. Shelterbelts 'dense' throughout their height (impermeable to wind) . . .	77
III. Shelterbelts of 'medium density' (slightly permeable) below and 'dense' above .	69
IV. Shelterbelts of 'medium density' above and 'open' below	73

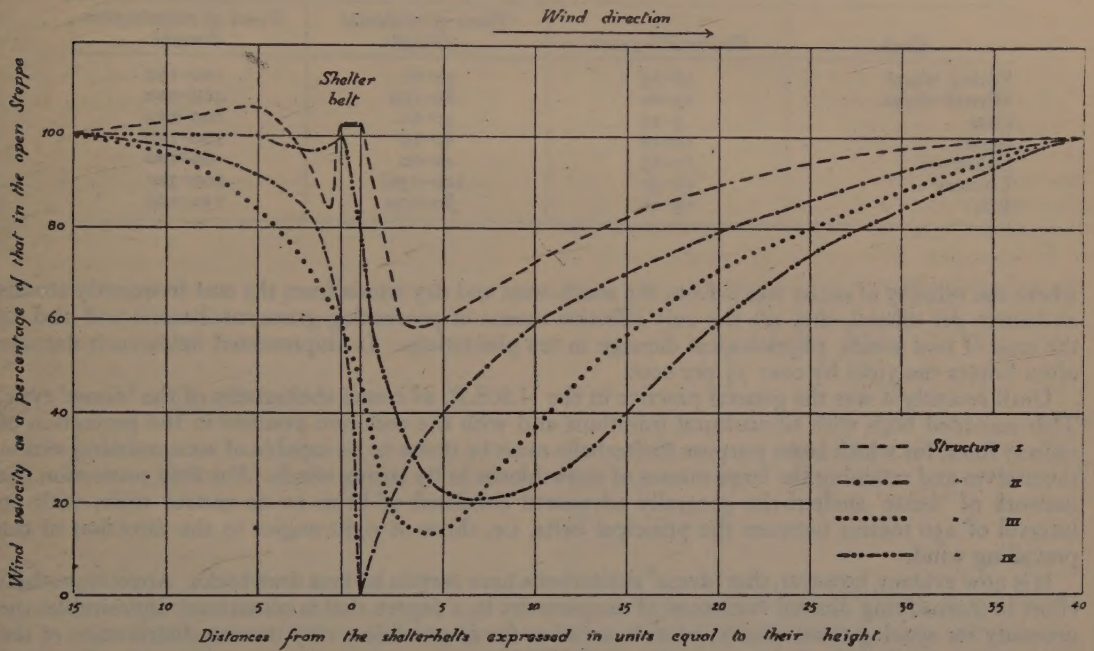
The effect is also shown in the following graph, based on observations at Rostashev, Timashev, and Guselsk in 1933.

A second effect of shelterbelts is the intensification of diurnal variations of temperature as shown by the observations of Vissotzky in Anatolia and of Bodrov in Rostashev. During the first half of the day, while the heat content of the 'active surface' is increasing, the effect is positive, but from 3 p.m. onwards until after sunrise next morning a cooling effect is produced. It may be stated generally that, during the summer period, the effect of shelterbelts in either direction is the more pronounced according as the weather is hotter and drier, the solar radiation higher, and the daily range of temperature greater. During very hot and dry days the temperature of the zone adjacent to the shelterbelts may rise as much as 6 degrees above that of the open steppe, as was demonstrated by Bodrov's measurements with unprotected thermometers; and in such cases the danger of sun-scorch is increased by the presence of shelterbelts. On the other hand, though they lessen the probability of advective frosts,

shelterbelts to some extent increase the likelihood of radiation frosts. Open shelterbelts intensify diurnal variations of temperature to a lesser degree than dense ones.

In the third place, as indicated by the data from the Kamenaja Steppe mentioned above, shelterbelts undoubtedly decrease evaporation from a free water surface, but the quantitative data obtained still lack precision, as the technique so far evolved for the investigation is in itself insufficiently accurate. Karusin's work at Timashev, north of Kuibishev, has, however, shown that shelterbelts do not produce any significant differences in the absolute moisture content of the air.

The protection afforded by shelterbelts against 'blowing out' of the snow cover depends largely on their structure. Data from Krasnokutsk (Kharkov, Ukraine), Rostashev, and Timashev showed that



(*After Panfilov*)

snow deposits between the belts were more regular and extensive in the case of 'open' belts and those of 'medium density' than where the belts were 'dense' or impermeable. In Timashev, for instance, belts of 'medium density' resulted in uniformly deep deposits of snow stretching to a distance of 250 metres on the lee side, while 'dense' belts caused great accumulations of snow within a distance of 100 metres, the rest of the area being left with a scanty covering of snow.

A fifth effect of shelterbelts, namely their influence on soil moisture in areas intervening, was examined at all field stations and in particular detail at Timashev. The data at that station for 1932 and 1933 did not reveal any appreciable effect in the upper layers of the soil, but there was a significant difference in favour of the areas protected by shelterbelts in the deeper layers, 25–50 centimetres below ground-level. At this depth there was an increase of moisture content by 3–4 per cent., and in some cases by 7–8 per cent., to a distance of 100 metres from the shelterbelts.

Finally, the effect of shelterbelts on fertility, as expressed in the yield of field crops, has been shown to be most pronounced in years of catastrophic drought and least marked when weather conditions are favourable. This effect is subject to regional variation and also varies with different species and even varieties of field crops. The following table (from Sus) will serve as an illustration. It shows the increase of yield due to shelterbelts expressed as a percentage of average yields from comparable fields without such shelter. The data represent rough averages for the dry regions of Russia.

In the drought year of 1933 it was found at Timashev that the field crops that benefited most from

shelterbelt protection were the introduced, or less drought-resistant, varieties. In Guselsk (Saratov, Southern Russia), where a detailed study was made of the effect of shelterbelts on the yield of garden and industrial crops, it was found *inter alia* that shelterbelts 5–7 years old and 3–4 metres high, planted at intervals of 125 to 250 metres apart, made it possible to cultivate certain garden crops, including cucumbers and tomatoes, *without irrigation*. According to Sokolov, the tomato crops protected by shelterbelts were far less affected by bacterial disease. Shelterbelts are also of very great importance in the protection of subtropical plantations. Thus, Dolidze reports that in western Georgia,

Percentage Increase in Yield under the Influence of Shelterbelts

Crop.	*Favourable years.*	*Years of moderate drought.*	*Years of catastrophic drought.*
Spring wheat	10–15	50–60	100–150
Winter wheat	15–20	80–100	400–500
Oats	5–10	50–60	100–150
Barley	10–15	50–60	100–150
Sunflower	10–15	40–60	80–100
Lucerne	20–30	100–150	200–300
Rye	15–20	80–100	150–200

where the velocity of moist winds from the south-west and dry winds from the east frequently attains 20 metres per second, they are the only effective means of preventing grave mechanical and also, in the case of east winds, physiological damage in tea plantations. In unprotected fields such damage often lowers the yield by over 75 per cent.

Until recently it was the general practice in the U.S.S.R. to create shelterbelts of the 'dense' type. This accorded both with silvicultural traditions and with the common practice in the protection of railway lines, for which latter purpose shelterbelts must be dense to be capable of accumulating within themselves and retaining the large masses of snow blown in by strong winds. For field protection the network of 'dense' shelterbelts generally advocated consisted of belts 10–20 metres wide, with an interval of 250 metres between the principal belts, i.e. those at right angles to the direction of the prevailing wind.

It is now evident, however, that 'dense' shelterbelts have certain serious drawbacks. Apart from their effect in intensifying diurnal variations of temperature to a degree that is sometimes undesirable, the necessity for spacing them closely, so as to avoid as far as possible a very uneven distribution of the snow cover, results in such fragmentation of the field area as may constitute a serious impediment to mechanical farming. More attention is therefore being devoted to 'open' shelterbelts, and those of 'medium density', which do not produce such drastic changes in wind velocity but exercise a more moderate effect extending to a greater distance, and therefore do not need to be spaced as closely as 'dense' shelterbelts. An advantage of the more open types of shelterbelt is that they tend to accumulate relatively little snow and allow it to spread more evenly over the fields.

A recent suggestion put forward, among others, by Matjakin is that shelterbelts should be given a 'stepped' or a 'zigzag' alignment. Such shelterbelts could be spaced closely and would afford effective protection from all directions without serious interference with mechanized farming. The method would be particularly valuable for the sandy semi-deserts, where poor conditions for tree-growth prevent the creation of high shelterbelts and where, at the same time, strong winds and even sand-storms constitute a menace which may come from any direction.

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MATJAKIN, G. I. Shelterbelts of the half-desert zone and their effect on the micro-climate of the intervening territory. *Communications of the All-Union Scientific Research Institute for Rural Melioration with the Aid of Forestry*, No. 8: 'Shelterbelts', pp. 65–119. Moscow, 1937.

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DOLIDZE, S. Y. Windbreaks on tea plantations. *Soviet Subtropics*, 1936, No. 2, pp. 18–23, with English summary.

ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g.[G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

0. GENERAL FORESTRY

01. *Theories. Terminology. Methods*

01.1. STOATE, T. N., and LANE POOLE, C. E. **Application of statistical methods to some Australian forest problems.** *Commonwealth Forestry Bureau Publication*, No. 21. 1938. pp. 71.

Examples are given of the design and analysis of simple and of factorial (complex) experiments. The significance of the standard deviation and standard error in statistical analysis is discussed simply.

01.2. DESCH, H. E. **Trade names** (of timbers)—Nomenclature difficulties and suggestions for remedying them. *Mal. For.* 7, 1938 (153–60).

The new list of trade names for Empire timbers given in the fourth edition of the Empire Forestry Association Handbook is criticized for its inconsistencies, arising from a policy of compromise by a body having no authority to impose its recommendations. 'Borrowed' names are admitted in the list in some cases, e.g. 'Rhodesian Teak', and discountenanced in others, e.g. 'Philippine Mahogany', and the inaccurate use of a geographical prefix is sanctioned in 'Borneo Camphorwood'. The author recommends that 'borrowed' names should be dropped unless applied to genuine close relatives that are themselves technically similar to the original timbers; e.g. 'African Mahogany' would be permissible for *Khaya* spp. Geographical adjectives should not be misapplied. Names should be assimilated for commercially identical timbers, for example 'Apitong' might be applied, with geographical qualifications, to Keruing and Gurjan, just as Iroko has been adopted as a trade name for *Chlorophora excelsa* from any African source. When a name is required for a timber not yet established in world markets a vernacular name is to be preferred to either a coined name or the generic appellation. A strong and disinterested committee, empowered with the authority of a Royal Commission, should be appointed to formulate and give effect to strict rules governing the use of trade names.

01.2 : 31. MARKWARDT, L. J., and HECK, G. E. **Standard terms for describing wood.** *Publication* of Forest Products Laboratory, Madison, Wisconsin. January, 1938. pp. 7.

A graduated set of descriptive terms, each corresponding to a certain numerical range of the property (physical or mechanical) under consideration, is presented and explained for the use of foresters. A table is appended, describing the properties of the woods grown in the United States by comparative figures and descriptive terms.

01.4. CLARKE, S. H. **The use of perforated cards in multiple-entry identification keys and in the study of the interrelation of variable properties.** *Chronica Botanica* 4, 1938 (517–18).

The identification keys adopted at Princes Risborough permit the use of diagnostic features in any desired order, are simple to operate, and require the minimum of apparatus. The method is particularly valuable where it is desired to study the interrelations of three or more variables.

07. *Education. Research. Travel and Study*

07 : 05.3 (42). **Fourteenth Annual Report and Prospectus of the Imperial Forestry Institute, University of Oxford, 1937–8.** 1938. pp. 34.

The chief interest of the report lies in a statement on behalf of the University, outlining its future policy with regard to education in forestry. This policy springs from the conclusion

that it is not possible, within the limits of a three-year undergraduate course, to make adequate provision for both the forestry subjects and the fundamental studies which should precede, and form the basis for, the professional training of a fully qualified forest officer. The possibility of supplying the deficiency in such studies, inevitable under the three-year system, in a subsequent year of post-graduate training is likewise rejected. The remedy is to raise the standard for entry, and in future undergraduate training is to be limited to students who have taken honours in Science Moderations at Oxford. The two-year course in forestry will be open only to students with this minimum qualification and to graduates with honours in an approved Final School at Oxford or elsewhere. Post-graduate instruction will predominate, and the three-year undergraduate course will be abandoned. The changes are designed in conformity with the new Scholarship Scheme of recruitment to the Colonial Forest Service, under which a proportion of the recruits will be graduates with honours, normally in the natural sciences ancillary to forestry. After selection these men will be given scholarships to enable them to undergo training in forestry. The course of training will extend over a period of two years, which will be taken separately with a period of practical experience between.

The courses hitherto given at the Imperial Forestry Institute for graduates in forestry appointed on probation to the Government services, forest officers on leave, and others will be maintained. Studies for the Diploma of Forestry will continue on the same lines, but may be undertaken only by holders of a degree in forestry or equivalent qualification. The Institute and School of Forestry will be merged into a single organization with the status of a University Department under the University Professor of Forestry, and the post of Director of the Institute will disappear. Certain fundamental teaching will be devolved on other University Departments, and the study of the literature of world forestry will be undertaken by an Imperial Forestry Bureau to be set up in liaison with the Institute by the Imperial Agricultural Bureaux organization. The statement makes clear that the change in the system of training is no new departure, but the culmination of a movement, dating back for a quarter of a century, to raise the standard of education in forestry.

07.8 : 23 (54.1). GRIFFITH, A. L. **Notes on a tour in South Bengal in Nov.–Dec. 1936.** *Superintendent, Govt. Press, Madras.* 1938. pp. 36.

A study of the work done in Bengal on (1) the silviculture of Mahogany (*Swietenia macrophylla*) and its protection against insect pests, and (2) the regeneration, natural and artificial, of evergreen forest; stress being laid on data likely to be of interest to Madras.

09. *Forest History. Forest Geography. Monographs on individual countries and forest regions*

09.1 (68). KING, N. L. **Historical sketch of the development of forestry in South Africa.** *Jnl. S.A. For. Assn.* 1, 1938 (4–16).

The South African Forest Service, created in 1847, now controls over 3 million acres of land and has a staff of 71 technical officers, 228 foresters, 400 foremen and forest guards, and 69 men in the clerical division. Direct employment is given to about 7,000 forest labourers, while about 5,000 men work in sawmills, factories, &c., which depend on the plantations for raw material. Remarkable success has been achieved in the acclimatization of suitable species from other countries and in works of protection and reclamation. The yield of sawn timber from plantations amounts at present to about 8½ million cu. ft. a year, while that of indigenous timbers is only 370,000 cu. ft. The present area of coniferous plantations, 238,000 acres, can be doubled even if no more land is purchased. It is the aim of the Forest Service to make the State as independent as possible of timber imports.

09.4 : 98 (47). BUCHHOLZ, E. **The withdrawal of the U.S.S.R. from the world timber market.** *Zeitschr. f. Weltf.* 6, 1938 (141–67). [G.e.]

The downward trend of timber exports since 1935 is closely related to the general reduction in exports subsequent to the paying off of the foreign debts incurred in connexion with the heavy imports of 1928–32. At present the U.S.S.R. is exporting only about 6 per cent. of its total timber production. The volume of production still lags far behind the figures aimed at, the main reason being the unsatisfactory living and housing conditions of the forest workers, which make the supply of additional labour a very difficult problem.

09.7 (66). GUINIER, P. **The forests of French West Africa—their study from the botanical and forestry points of view by colonial foresters.** *Rev. E. & F.* 76, 1938 (675–93). [F.]

It is only in recent years that French colonial foresters have made an intensive study of forest botany on the lines previously followed by foresters in India, such as Brandis, Kurz, Gamble, and Troup. The following recent contributions of French colonial foresters on this subject relating to French West Africa are reviewed: AUBRÉVILLE, A. La flore forestière de la Côte d'Ivoire, 3 vols., 789 pp., 351 pl. Paris, Larose, 1936. AUBRÉVILLE, A. La Forêt de la Côte d'Ivoire. Essai de géobotanique forestière. *Bull. du Comité d'études historiques et scientifiques de l'A.O.F.*, vol. 15, Nos. 2–3, 1932, 45 pp. AUBRÉVILLE, A. Les reserves de bois de la Côte d'Ivoire. *Bull. du Comité d'études historiques et scientifiques de l'A.O.F.*, vol. 15, No. 2–3, 1932, 11 pp. AUBRÉVILLE, A. Les Forêts de la Colonie du Niger. *Bull. du Comité d'études historiques et scientifiques de l'A.O.F.*, vol. 19, No. 1, 1936, 95 pp., 6 pl. AUBRÉVILLE, A. Les Forêts du Dahomey et du Togo. *Bull. du Comité d'études historiques et scientifiques de l'A.O.F.*, vol. 20, No. 1–2, 1937, 112 pp., 8 pl. BÉGUÉ, L. Contribution à l'étude de la végétation forestière de la Haute Côte d'Ivoire. *Publication du Comité d'études historiques et scientifiques de l'A.O.F.*, série B, No. 4, 126 pp., 49 pl.

09.7 : 11.21 (67.5). LEPLAE, E. **The great equatorial forest of the Congo: its influence upon rainfall; clearings necessary for the prosperity of the natives.** *Extract* from *Congo—Revue générale de la Colonie belge.* 1937. Goemaere, 21 rue de la Limite, Brussels. pp. 70. [F.f.]

The extent to which deforestation has taken place in the Belgian Congo has been exaggerated by many writers. Lebrun's survey [*Distribution of the equatorial forest and of the plant formations of its neighbourhood*, pp. 196, 71 figs., 2 maps, Ministère des Colonies, Brussels] and inquiries since 1932 have shown that no cleared areas over 25 square kilometres in extent, no large savannah formations, and no secondary forests of over 1,000 hectares exist within the Great Forest. The maps of the Belgian Congo, in most of which the forest area is underestimated, are criticized in detail.

The area of forest is estimated [for 1937] at 125,552,000 hectares or 53·50 per cent. of the total area of the colony. The Belgian Congo has therefore a higher percentage of forest than other equatorial and tropical colonies.

The influence of forest on rainfall is discussed in detail, with the conclusion that the forests of the Belgian Congo have no appreciable influence on rainfall.

Compulsory plantation in native cotton fields of trees yielding an exportable crop is advocated. The clearing of forest and permanent reclamation of the cleared land for agriculture are suggested for certain parts of the colony with a view to the development of native agriculture on a more stable basis.

Nine maps are reproduced in the Appendix, which also contains a draft project for native agricultural colonization and a calculation of the forest area of the colony.

09.7 : 03.5 (71.5). MORISON, M. B. **The forests of New Brunswick.** *Canada For. Serv. Bull.* 91. 1938. pp. 112.

A general account is given under the following headings: physical features, geology, and climate; the native trees of New Brunswick; methods of survey, land classification, and timber estimating; forest economy, including land and timber disposal, administration, the value of the forests, and the conduct of forest research; logging methods; increment and depletion. There follows a survey by districts, with tables showing the classification of land and estimates of volume. Of the total area of the province, amounting to 27,985 square miles, productive forests occupy 21,773 square miles; and of these 10,682 belong to the Crown. Of the total productive forest 38·1 per cent. is coniferous, 10·2 per cent. hardwood, and 51·7 per cent. of the mixed wood type. The principal species are Spruce, Balsam Fir, White Birch, and Yellow Birch. Softwoods are cut at an average rate of 125 million cu. ft. per annum, which is only 25 million cu. ft. less than the estimated admissible cut, but the utilization of hardwoods is very much less than the quantity available. Stricter control is recommended of cuttings in both private forests and leased Crown lands, and the need is stressed for silvicultural research and intensive surveys of the forest area.

09.7 : 03.5 (83). MILLER, D. **Chiefly on Chilean forests.** *N.Z. Jnl. For.* 4, 1938. (161–71).

Tour notes on forests of the different botanical zones of Chile, with a sketch-map showing these zones.

11. *Locality. Study of locality. Maintenance of locality factors*

11.14 (67.5). GOEDERT, P. Les sols de l'Afrique Centrale, spécialement du Congo Belge: Caractéristiques pédologiques. Fertilité. Introduction: Le régime pluvial au Congo Belge. **[The soils of Central Africa, especially of the Belgian Congo: Pedological characteristics. Fertility. Introduction: The rainfall conditions of the Belgian Congo.]** pp. 45. L'Institut National pour l'Étude Agronomique du Congo Belge, Brussels, 1938. [F.]

The rainfall of the Belgian Congo is analysed on the basis of records from 131 stations. The rains occur in spring, summer, and autumn, and may conveniently be described as summer rains. There is a steady increase of annual rainfall from all sides towards the central basin, which receives over 210 cm. and shows little variation from year to year. Highlands shelter the inland basin from sea winds, and part of its heavy rainfall is derived from its own reserves of moisture [rivers, lakes, marshes, and forest]. Near the coast, however, and under the influence of the irregular alternation of cold and warm ocean currents [the Benguela and Guinea streams], the yearly variation in rainfall may be over 80 per cent.

11.14.3 : 12.11.2 (73). ANTEVS, E. **Rainfall and tree growth in the Great Basin.** Carnegie Inst. of Washington Publication No. 469. Am. Geogr. Soc. Special Publication No. 21. 1938. pp. 97.

On the dry limit of the forest in Susanville and Lakeview it was found that tree growth corresponded to the water supply available during the growing season in about 75 per cent. of the years, and groups of especially wide or narrow rings corresponded in a general way to pronounced and extended maxima and minima of the annual rainfall in about 90 per cent. of the cases examined. There was considerable variation due to local conditions and other factors. Tree-ring curves, therefore, when taken alone, permit of only general and somewhat conditional conclusions regarding rainfall fluctuations in the past.

11.14.4. DÖBELE, E. **Observations on the question of hoar frost.** *Thar. For. Jahrb.* 89, 1938 (424–35). [G.]

Stresses the importance of the influence of eastern and southern fogs on the formation of hoar frost, not only in the Erzgebirge, which, according to the author, is the typical region for damage by hoar frost but also, with some exceptions, in other German and Austrian mountain forests which have been examined from this point of view. Coal-dust fogs rising from Northern Bohemia have some effect in intensifying hoar frost formation in the Erzgebirge.

11.4. *Soil*

11.4. HEUSON, R. Bodenkultur der Zukunft. [**Soil cultivation of the future.**—Rehabilitation of overworked agricultural and forest soils, and of soils of waste land.] pp. 96. J. Neumann, Neudamm, 1938. [G.]

There are in Germany at present about one million hectares of waste land and at least three million hectares are gradually becoming derelict. A large proportion of the waste land is the result of continuous removal of forest litter in the past or of prolonged cropping without due attention to the restoration of soil fertility.

The following procedure for reclaiming waste land is recommended:

1. *Pedological survey.* The proportion of pits to borings will generally have to be large in gravelly soils and those containing hard layers.

2. *Cultivation.* Soils of waste lands which in the past have either been cultivated or under forest usually have an isolating layer of powdery sterile top soil, which must be mixed with the underlying mineral soil. Iron deposits and layers of extremely compact gravel and sand must be loosened. Where different mineral soils are found in sharply defined layers, a mixture should be aimed at. For reasons of economy cultivation will generally have to be in strips.

3. *Restoration of fertility.* Most waste lands are extremely poor in nitrogen, humus, and bacteria, and whatever mixture of species for afforestation should be decided upon, it is essential to include a soil-improver. The author achieved remarkable success with *Alnus glutinosa*, in mixture with other broad-leaved trees and with *Pinus sylvestris* respectively, and considers it a much more reliable soil-improver for waste lands, including dunes, than *A. incana*. In some cases manuring may be justified. The use of a mixture of chalk and soft brown-coal (a soft form of lignite occurring in Germany) inoculated with bacteria is recommended.

Large-scale reclamation of waste land can be achieved only by the State or with State assistance and under State control.

11.42.3 (43.72). PELISEK, J. **On the reaction of forest soils in the Vysoký Jeseník mountains in Moravia.** *Lesnická Práce.* 17, 1938 (373–87). [Cz.g.f.]

A study of soil acidity in the Vysoký Jeseník mountain region of northern Moravia showed that the upper layers of the soil profiles of the forest zone at an elevation of 570–1,100 metres were much more acid than those of the Nardus zone at 1,350–1,490 metres. Within the forest zone, which consisted essentially of very old and dense Spruce, elevation and aspect did not seem to have any considerable influence on the acidity of the soil, which was generally a humus podsol. The pH–H_2O ratio of the humus horizon was 4·09–4·26, the pH–*n*KCl 3·06–3·57. The pH–H_2O of the humus horizon of the Nardus zone was 4·54–4·81, the pH–*n*KCl 3·32–3·79. Both in the forest and the Nardus zone the acidity, as well as the difference between the pH–H_2O and the pH–*n*KCl values, diminished in the lower soil horizons.

11.43.1. RAYNER, M. C. **The use of soil or humus inocula in nurseries and plantations.** *Emp. For. Jnl.* 17, 1938 (236–43).

Summary and discussion of information received in response to a questionnaire issued by the Imperial Forestry Institute. Attempts to establish mycorrhizal association, where lacking, have become a commonplace in forestry practice. At the same time, an unsatisfied demand exists on the part of foresters for a wider knowledge of the established facts in respect of mycorrhizal infection in trees.

11.43.1. MCCOMB, A. L. **The relation between mycorrhizae and the development and nutrient absorption of Pine seedlings in a prairie nursery.** *Jnl. For.* 36, 1938 (1148–53).

In a nursery established on old agricultural land at Ames, Iowa, it was found *inter alia* that a large proportion of *Pinus virginiana* seedlings ceased growth almost entirely in the middle of the first growing season as a result of insufficient phosphorus nutrition in the absence of mycorrhizal association. Only seedlings with mycorrhiza present in their roots absorbed phosphorus at a sufficient rate and developed in a normal manner.

11.44 : 11.47.6. RŮZICKA, J. **Sealing-up of the topmost layer of forest soils is in most cases the true cause of trouble in forests.** *Lesnická Práce* 17, 1938 (273–90). [Cz.g.]

The importance is stressed of keeping the top soil as loose as possible, particularly in seed-beds and young plantations. Spruce is much more sensitive to a soil cover of raw humus, weeds, &c., than are Larch and Pine. In clear-cut strips of under 30 metres in width the soil cover, including forest humus, should if possible be removed provided that there is no danger of invasion by heather. As an economic measure of soil amelioration the author advises stumping without replacement of the disturbed soil. Artificial reconditioning with the aid of potatoes and of *Lupinus polyphyllus* (to be cut in June) is also effective against the sealing-up of the top soil; but cereals have a negative effect because of the stubble. The surface of the soil should be kept as irregular as possible to obtain shade and encourage the formation of dew and mist. Spruce under 20 years of age which has suffered from the sealing-up of the top soil may still be saved by 'turning' or digging in the weed-growth covering the ground between the stems. The best way of preventing sealing-up of the soil of stands in the pole stage consists in moderate and frequent thinnings. The author does not believe in the theory of so-called 'soil fatigue', but holds the view that all phenomena ascribed to it are really due either to a wrong choice of species or seed, or to the sealing-up of the top soil.

11.44.2 : 11.42.2–3. HWANG, Y. **Field experiments on nitrogenous decomposition and acidity changes in decaying forest litter.** *Forstw. Centralbl.* 60, 1938 (661–76). [Cz.g.]

The experiments were made at Schleissheim, near Munich, in the experimental area of the Soil Science Institute, with litter of *Quercus sessiliflora*, *Fagus silvatica*, *Carpinus betulus*, *Acer platanoides*, *Aesculus hippocastanum*, *Populus tremula*, *Pinus silvestris*, *P. laricio*, *P. strobus*, and *P. banksiana*. The arrangement adopted was similar to Henry's frame method (HENRY, E. Les sols forestiers. Paris-Nancy, 1908, pp. 130–1).

In most cases the nitrogen content of the decayed litter was found to be higher than that of the initial material, allowance being made in the case of the litter of broad-leaved species for the amounts absorbed by plants or leached during the process of decay. In the majority of

cases there was no need to make this allowance for coniferous litter, which showed an *absolute* increase of nitrogen after decomposition. Mobilization of nitrogen appeared to be considerably slower in the case of coniferous litter.

A correlation was found between the initial pH of the litter, the pH of the underlying soil, and that of the decomposed material. Deciduous litter had in the main a basic, coniferous an acid buffer-effect, except in some cases where litter of the former type was on a basic soil, or of the latter on a very acid one; their respective buffer-effects were then somewhat contrary to the normal. It was also found that an admixture of broad-leaved to coniferous litter assisted the decomposition of the latter, and that the action of wind seemed to favour considerably the decomposition of broad-leaved litter, inasmuch as it resulted in the litter being brought into more intimate contact with the soil and its micro-organisms.

11.47 : 11.44 : 11.43.1 (494). BURGER, H. **Preliminary results of experiments on soil improvement in the State Forest of Zofingen.** *Mitt. Schw. Anst. forstl. Versuchsw.* 20, 1938 (247–306). [G.g.f.]

DÜGGELI, M. **Studies on the influence of the soil improvement measures in the State Forest of Zofingen upon the bacterial flora of the forest soil.** *Mitt. Schw. Anst. forstl. Versuchsw.* 20, 1938 (307–444). [G.g.]

Provisional results are given of experiments, begun in 1933 in the *Unterwald* of the town of Zofingen, on the amelioration of a naturally fertile forest soil that had become degraded under the combined influence of clear-cuttings, temporary agricultural utilization, and maintenance under a purely coniferous stand. The effects of hoeing, removal of moss and raw humus, manuring, covering the soil with litter and inoculating it with different quantities of fertile forest earth, and under-planting the crop (mainly 60-year-old Spruce) with Beech were examined in their separate and combined effects on the soil and its ground flora and bacterial population. It was found *inter alia* that removal of moss and raw humus from, and hoeing the top soil had resulted after an interval of 6 months in a decrease of its permeability by one-half to three-quarters, that liming to the extent of 500 grammes per sq. metre neutralized the soil acidity sufficiently to permit of nitrification; that the combined effect of liming and inoculation produced most marked changes in the ground flora, involving in some cases the appearance of over 25 new species and considerable diminution of *Polytrichum* and *Catharinaea*; and that while under-planting with Beech had not so far affected the soil reaction, it did protect the top soil from sealing-up. The bacterial population was most favourably influenced by hoeing, liming, artificial manuring, inoculation, and under-planting with Beech, while the removal of the raw humus, the covering of the soil with litter, and the addition of ashes had scarcely any effect in this respect.

11.47 : 12.11.1 : 12.25.53 (43.71). NEMEC, A. **A further contribution to our knowledge of deficiency symptoms in seedlings and crippled stands of Pine.** *Lesnická Práce* 17, 1938 (388–402). [Cz.g.f.]

Chlorosis of Scots Pine seedlings and plantations of different ages at Lysa (Bohemia) occurred on very acid sandy soils which were extremely poor in available calcareous matter, potassium, and magnesium. Phosphoric acid was in some cases being leached from the upper soil horizons. Analysis of needles and branches revealed that the stunted yellow or yellowish trees had suffered from lack of potassium and magnesium, and that an excessive quantity of manganese had been absorbed by both needles and wood, causing their intoxication and a consequent reduction of chlorophyll formation and photosynthesis.

11.47.13. HILF, H. H. **The manuring of poor sands with basalt grit.** *Forstarchiv* 14, 1938 (93–101). [G.g.]

In a previous paper the author described the success of preliminary experiments on the manuring of poor sands with waste basalt from road-metal quarries. The present article is a progress report on experiments on the Finowtal valley sands. The area, which had been ploughed and planted with Pine in 4 : 1 mixture with other conifers and hardwoods, was divided into 12 experimental plots and treated with graduated amounts of basalt. The beneficial effect of basalt in improving water retention and supplying deficient mineral nutrients brought about a striking increase of growth in most of the hardwoods. A small improvement was also noticeable in the conifers, and it is expected that they will benefit indirectly from the accumulation of hardwood litter and humus. Costs of material and transport are discussed. The most suitable material is said to be a 9 : 1

mixture of basalt grit and basalt dust. Present experience suggests that the required amounts of basalt are as follows: 1–3 kg. per planting hole for larger plants, 0·2 kg. for 1-year-old seedlings, and layers 1 mm. deep on ploughed land and 1 cm. deep in nursery plots. It is suggested that suitable fertilizers may also be obtained from other minerals such as gabbro and diabase.

11.47.13. ALBERT, R. **On the use of fine debris from stone quarries for the improvement of poor forest soils.** *Forstarchiv* 14, 1938 (229–40). [G.]

Basaltic stone debris increases the fertility of poor forest soils. The immediate and lasting effect is ascribed to the chemical nutrients made available, the addition of active mineral colloids, the neutralizing effect on acid humus and to the action of traces of such elements as iodine, fluorine, boron, manganese, and copper. The stone debris studied were sands (0·2–2 mm.) and 'meals' (below 0·2 mm.). Their chemical examination by ordinary analysis and electrodialysis gave results differing largely according to their localities of origin. The debris of diabase was found to have a similar fertilizing effect.

11.47.13 : 11.42.31 : 11.43.1 : 12.25.53 (943). YOUNG, H. E. **The acidification of alkaline nursery soils for the production of exotic Pines.** pp. 16. 1938(?). Govt. Printer, Brisbane, Australia. *Dept. of Agric. & Stock, Queensland, Div. of Plant Industry* [*Research*], *Pamphlet* No. 58. *Repr.* from *Queensland Agric. Jnl.* Nov. 1938.

Describes experiments at Yarraman (Southern Queensland) in the application of varying quantities of ground sulphur. The relatively best development in *Pinus caribaea* seedlings, as judged by highest survival, maximum average height, and most satisfactory mycorrhizal development, was obtained after treatment of the soil of the seed-bed with 1½ lb. of sulphur to every 12 sq. ft.

11.47.13 : 11.47.19 : 11.46. WIELER, A. **The effect of lead and zinc compounds upon growth and development in cultivated plants.** *Mitt. Forstwirt.* 9, 1938 (175–91). [G.g.]

The author's tests and observations show that, on the whole, compounds of lead have little influence on the growth of conifers in either acid or alkaline soils. Zinc was generally more noxious in acid than in alkaline soils, that is to say, a smaller amount was sufficient to impede plant development in the former; and in agricultural soils the quantity at which the poisonous effect of zinc on the growth of crops becomes pronounced is assumed at 0·16–0·19 per cent. Spruce, Scots Pine, and Dwarf Mountain Pine (Krummholzkiefer) were, however, much less sensitive, and even showed improved development in garden soils containing 0·19 per cent of zinc. According to the author, the addition of chalk is capable of counteracting the effect of zinc only to a certain degree.

11.47.13.1 : 23.23.11. CHANDLER, R. F. **The influence of nitrogenous fertilizer applications upon seed production of certain deciduous forest trees.** *Jnl. For.* 36, 1938 (761–6).

Applications of fertilizer resulted in a considerable increase of the total number of seeds produced by Beech and Sugar Maple. Stimulation was marked in the case of Sugar Maple, which showed in addition an increase in the percentage of sound seed and in the dry weight of individual seeds. Although these two species only were used in the experiment, the results are considered sufficiently striking to deserve further attention. The cost of fertilizers is too high to encourage general use of the method, but tree geneticists and others wishing to obtain seed from particular trees might find it useful.

11.47.2 : 11.44. KRAMMER. **Thoughts on the raising of the yield capacity of sandy soils in dry regions.** *Forstw. Centralbl.* 60, 1938 (458–64). [G.]

The author suggests silvicultural and other methods of preventing the deterioration of, and stimulating formation in, dry sandy soils.

11.47.21 : 38.65 (942). RANKIN, M. A. **Plantation preparation on logged areas of *Pinus radiata*.** *Austral. For.* 3, 1938 (9–14).

Special precautions are made necessary in the disposal of Pine slash by burning on a large scale under high risk conditions at Mount Burr Forest, South Australia. Problems concerned with the external break, sub-division of the burn, clearing of breaks, character of the burn, burning of breaks and the main burn are discussed. Present experience indicates the main considerations as:

(1) Early planning of the plantation layout.
(2) Clearing of slash-covered breaks with mechanical appliances.

(3) Felling of useless trees with the logging or after the burn.
(4) In burning operations—care with the back burn, lighting a short forward fire in strips, and reduction of an encircled unburned area to a safe minimum.
Author's summary.

11.47.21 : 11.43.1 : 23.21.6(67). CLEMENTS, J. B. **Trials in Nyasaland of introduced Pines.** *Austral. For.* 3, 1938 (21–3).

Repeated efforts to establish various exotic Pines in Nyasaland failed until inoculation of nursery plots and planting holes with mycorrhiza-infected soil was tried. Since the introduction of such technique results have been very successful.

11.47.6. MĂRAN, B. **Results of observations on the micro-climate and soil of stands underplanted with Spruce.** *Lesnická Práce* 17, 1938 (615–46). [Cz.g.f.]

Podsolization and general loss of fertility were found to be more pronounced in pure Pine stands than in those underplanted with Spruce.

11.48.1 : 12.19 (921). SEWANDONO, M. **Peat areas of Bengkalis (Sumatra).** *Tectona* 31, 1938 (99–135). [Du.g.]

The formation is described of a high peat moor in the islands and coastal regions of Bengkalis. Mangrove forest on low-lying alluvial deposits represents the first stage of the succession. Further sedimentation and the accumulation of plant remains gradually raise the soil level above high-water mark, when the land becomes unfit for mangroves. Favoured by the high, well-distributed rainfall, moor formation then continues and the soil mass is brought above coast level. The highly acid peat areas thus formed have the characters of a high moor. Three successional stages may be recognized in the vegetation: mangrove forest, Nibong (*Oncosperma filamentosum* Bl.) forest, and moor forest. Within the moor forest further stages are distinguishable: towards the interior, the forest gradually declines in vigour and density, undergrowth increases, dead and dying trees become more frequent, and regeneration of the dominants decreases. These changes are accompanied by increase in the depth of peat and the ground becomes more hummocky, with increasing liability to floods; in the central zone of poor open forest and grassland the ground is almost perpetually inundated. The reasons for the changes are said to be obscure.

11.6. *Hydrographical Conditions*

11.62.1 : 11.63.1(54). GORRIE, R. M. **Soil losses from Indian forest grasslands and farms.** *Ind. For.* 64, 1938 (327–8).

Six forest plots were laid out at Nurpur, Kangra district, on a hill-side of poor Siwalik sandstone with a slope of 1 in 4. Measurements spread over 32 wet days in July–October 1937 show a surface run-off of 25 per cent. from bare soil as against 5–7 per cent. on soil covered with grass or grass and shrubs. The losses of soil per acre are estimated at 18,500 lb. and 3,500–3,900 lb. respectively. A single storm carried away soil from uncovered plots at the rate of 1½ tons per acre. On a field of *jowar* at Sholapur, with a gradient of 1 in 80, the loss of soil per acre in 2 years was 115 and 133 tons, whereas fallow land with weeds lost only a two-hundredth of these amounts.

11.62–3 : 42.31. BATES, C. G. **Reforestation and flood control.** *Jnl. For.* 36, 1938 (1073–9).

Great stress is laid upon the fact that all catchment areas have a certain maximum storage capacity which varies with geological structure and the absorptiveness of the soil. Water in excess of this maximum will contribute to floods whether forest is present or not; hence in assessing the value of forests in flood control the local geological and soil conditions must not be overlooked. The role of forest cover is not in itself to provide a reservoir for water but to ensure the fullest use of the natural storage capacity of the soil by developing and maintaining ideal conditions for absorption. The author illustrates his remarks by reference to the Root River catchment area in Minnesota. He concludes that a premium should be placed on the maintenance of farm woodlands as a means of securing the storage of water desired.

11.62–3 (73). KITTREDGE, J. **The magnitude and regional distribution of water losses influenced by vegetation.** *Jnl. For.* 36, 1938 (775–8).

By deducting run-off from precipitation a figure may be obtained for the sum of water losses caused by transpiration and interception, evaporation from the soil, and deep seepage. Although the data for the U.S.A. are far from complete, they are sufficient to show the approximate distribution of such losses, and a map has been constructed with lines of equal annual loss in inches of water. The distribution of water losses is shown to correspond in general with

that of the major forest regions. Losses are greatest in the south, where the highest temperatures and the longest growing season are experienced. Some correlation was also found between the order of the losses of the different types and the growth rate of well stocked forest stands.

11.63. *Forest and Water. Forest and Climate. Erosion*

11.63 : 11.62.1 (922). COSTER, C. Bovengrondsche afstrooming en erosie op Java **[Surface run-off and erosion in Java].** Archipel Drukkerij, Buitenzorg. *Korte Mededeelingen van het Boschbouwproefstation* No. 64. 1938. pp. 118. Appeared also in *Tectona* 31, 1938 (613–728). [Du.e.]

Observations and numerous experiments, the technique of which is explained and discussed in the author's English summary, were carried out in Java under different sets of conditions in respect of soil and climate. Run-off and erosion were found to be determined in the main by the extent to which the mineral soil was laid bare. On good forest soils run-off was below 1–2 per cent. and there was no erosion. When these soils were denuded the down flow increased to 30–50 per cent. and erosion to 5–12 kg. per sq. m. per year. The protection afforded by the various forms of vegetation depended chiefly upon the extent to which the soil was covered with herbaceous vegetation and litter. The formation of sods by bamboo or short grasses increased surface run-off but counteracted erosion. Primitive agriculture on slopes where no soil-protective measures had been taken had particularly serious effects in mountain forests, in which the layer of humus soil is shallow (10–15 cm.). Downflow was not very severe during the first two years after forest cultivation, but continuous cropping was followed inevitably by rapid erosion. On the other hand, intermittent agriculture (*ladang*) with fallow periods of several years' duration was not very harmful, the bare soils becoming rapidly covered after each clearing with herbs and shrubs.

11.63.1 : 42.34 (729.12). CROUCHER, H. H., and SWABEY, C. **Soil erosion and conservation in Jamaica, 1937.** *Dept. of Science and Agriculture, Jamaica, Bulletin* No. 17 [New Series]. 1938. pp. 20.

The chief causes of erosion in Jamaica are: cultivation of land unfit for permanent agriculture; exposure of the soil by forking or burning at the end of the dry season, which accelerates loss of soil during the rains; improper drainage; and the system of short-term renting of land, which offers no encouragement to planters to maintain soil fertility but results in shifting cultivation. Various suggestions are put forward for the control of erosion, and the authors appeal for proper co-ordination in an effective control programme of the activities of the Government agencies concerned.

11.63.1 : 42.34 (922). MOHR, E. C. J. **Climate and soil in the Netherlands Indies.** *Reprint* from *Bulletin of the Colonial Institute of Amsterdam* 1, 1938 (241–51).

The abundant rainfall in the Netherlands Indies is the cause of continually increasing impoverishment of the soil. Radical improvement in fertility is brought about only by the activity of volcanoes; at the same time, retrogression may be greatly retarded by means of scientific land management.

11.63.1 : 42.34 (54.5). GORRIE, R. M. **The conservation of Punjab water supplies.** *Ind. For.* 64, 1938 (675–87).

Erosion and run-off in the Punjab are discussed. Over large parts of the area drought damage has increased as the result of erosion. The worst unterraced fields of the Uhl catchment area should be afforested, and in the rest of the Province villagers should be taught to take up conservation work themselves.

11.63.1 : 42.3 (91). FLEMMICH, C. O. **River bank erosion in Brunei.** *Mal. For.* 7, 1938 (188–9).

Serious bank erosion along the Belait Tutong and Temburong rivers has followed the destruction of natural vegetation by the shifting cultivator. Sometimes a single line of trees, especially *Dipterocarpus oblongifolius*, can give considerable protection to a river bank. In future the retention of such protective strips should be enforced.

11.63.11 : 11.14.4 (74.7). DIEBOLD, C. H. **The effect of vegetation upon snow cover and frost penetration during the March 1936 floods.** *Jnl. For.* 36, 1938 (1131–7).

The investigations were carried out at the Arnot Forest, in the hill district near Ithaca, New York. During the winter of 1935–6 the soil was not frozen either at 12 stations in hard-

wood forest or at 6 stations possessing a herbaceous cover. The stations were protected by a relatively deep snow cover during the winter. Frozen soils occurred principally in bare exposed fields with a scanty covering of snow. At the time of the floods of March 1936 the melting of snow was slow at the forest stations in comparison with that at the open field stations. It is generally recognized that sudden melting of snow and run-off from frozen soils were major causes of these floods; the data presented suggest that the influence of hardwood forests is an important consideration in flood control programmes.

12. *Tree Species. Forest Botany*

12.11. Physiology. Biology

12.11.1. Gut, C. **The occupation of the atmosphere**—by vegetation. *Jnl. for. suisse* 89, 1938 (195–202, 262–9, 236–43). [F.]

The vertical distribution of carbon dioxide is more uniform in a selection forest than in an even-aged forest. In the former *all* leaves are capable of considerable assimilation, their morphology being adapted to medium light intensity, whereas in the even-aged forest the lower (shaded) foliage strata assimilate only to a small extent. Hence there is a better utilization of the atmosphere in uneven-aged stands.

12.11.2. Snow, A. G. **Use of indolebutyric acid to stimulate the rooting of dormant Aspen cuttings.** *Jnl. For.* 36, 1938 (582–7).

This study indicated that (1) dormant cuttings of Trembling and Large-toothed Aspen can be rooted to the extent of at least 65 per cent. by treating with 10 milligrams of indolebutyric acid per litre for about 27 hours; (2) maximum rooting is secured when dormant cuttings of these species are taken just before the buds are beginning to burst in the spring; and (3) abundant callus is not indicative of potential root formation. *Author's summary.*

12.11.2 : 12.14.3. Roze, E. Stādu saknu sakārtojuma un vasas angstuma pieauguma korrelācija. **[Correlation between the disposition of the roots and the height growth of plants.]** *Reports of the Latvian Forest Research Station*, No. 9. 1938. pp. 61. [La.g.]

The height increment of Pine and Spruce during the first 5 years after transplanting was found to be uninfluenced by the disposition of the roots in the soil at the time of transplanting. Care should be taken, however, to choose a method of planting that assures healthy root development.

12.11.2 : 12.25.53 : 12.15.2. Jacobs, M. R. **Notes of factors influencing the straightness of the internodes of *Pinus radiata*.** *Austral. For.* 3, 1938 (78–84).

This paper discusses distortion of the internodes of *P. radiata*, both on the leader and side branches. Most distortions in old internodes are remnants of disfigurations occurring in the expanding bud. Curves in the expanding buds are caused by wind pressure, desiccation or injury, the flopping of an expanding leader from its own weight, and geotropic recovery following any of the above curves or any other factor that brings the expanding bud out of the vertical. The main other factor bringing the bud out of vertical is the movement of the branch, which is weighed downwards as the male cones ripen, springs upwards as pollen is shed, and is weighed downwards again as the leafy zone develops. Geotropic recovery causes a sharp bend in the zone of intercalary growth, and a parabolical curve lower down the stem. The bend in the zone of intercalary growth develops in a day or two, the recovery lower down being progressively slower as the stem becomes larger and stiffer. Because of this the top straightens first, and the later straightening of the lower parts throws the tip over the other way, causing a geotropic over-bend. When this over-bend occurs the tip straightens again from the opposite side. The main permanent distortion of the leader arises through geotropic recovery following leader flop. In the side branches there is a regular undulation in both male-cone zones and leafy zones arising from the geotropic reaction of the branch to the changing angle caused by changing weight. The leafy zone of the side branches may also show geotropic kinks, which are especially noticeable in the part of the season's growth. Kinks in the leading shoots are less common in strongly multinodal strains. *Author's summary.*

12.11.3 : 12.15.2 : 12.28.47 (54.8). Laurie, M. V. **Branching and seed origin in Coorg Teak plantations.** *Ind. For.* 1938 (596–600).

Four different types of branching seen in Coorg Teak plantations are described and illustrated and the probability of their being due to hereditary factors is discussed. It appears that varieties arising from seeds from dry localities

may have considerably exaggerated characteristics when raised in damper and more favourable conditions. The necessity for ascertaining that the seed comes from a good origin when making Teak plantations is emphasized. *Author's summary.*

12.11.3 : 12.25.53. STROHMEYER, G. **Points of selection in the genetics of the Pine.** *Forstw. Centralbl.* 60, 1938 (152–7). [G.]

A review of the difficulties encountered in breeding desirable strains of Scots Pine. The most serious difficulty is that of recognizing in 1-year-old seedlings characters correlated with the factors governing the eventual form of the mature tree. The author discusses various seedling characters that might prove to show such a correlation, and urges the need for more research along this line.

12.11.3 : 12.15 : 12.25.53 (43). DENGLER, A. **Pines of foreign provenance in the second generation.** *Zeitschr. F. & J.* 70, 1938 (150–62). [G.g.]

Previous papers by Kienitz (1922) and Münch (1924) dealt with the first generation of Pines grown at Chorin from seed imported from Scotland, France, Courland, and the Rhineland Palatinate. Seed for the present study was collected at Chorin in 1926–7 and sown at Eberswalde in 1928. Germination was good and a large number of seedlings of the second generation was obtained. These were measured for height growth in 1931. A thinning was then made, and the young trees were left until 1933, when a second survey was undertaken. Additional characters recorded during the second survey were straightness of stem, needle characters, and anomalies in bud formation. Although the source of pollen had been impossible to establish with any degree of probability, the second generation showed a good general agreement with the first, and the several races continued to differ among themselves in the characters mentioned. Münch was unable to find evidence of acclimatization in the first generation and, according to the author's results, no such tendency is observable in the second.

12.11.5 : 12.26.21 (43.8). JENTYS-SFAZEROWA, J. Z badań biometrycznych nad zbiorowym gatunkiem *Betula alba* L. II. O mozliwości krzyzowania sie gatunków *B. verrucosa* Ehrh. i *B. pubescens* Ehrh. **[Biometrical studies in the collective species *B. alba*. II. The possibility of hybridization between the species *B. verrucosa* and *B. pubescens*.]** *Inst. Rech. For. Poland Trav. & Comptes Rendus*, Ser. A, No. 40. pp. 84. 1938. [Pol.e.]

The investigation was carried out in the Wola forest near Cracow. The author concludes that *Betula verrucosa* stands a very slight chance of being fertilized by pollen other than its own, whereas *B. pubescens*, which flowers 10–12 days later, is capable of being fertilized to some extent both by *B. verrucosa* and by pollen of hybrids.

12.12. Pathology

12.12 : 12.25.53. HEARMAN, J. **Minor elements and the Pine.** *Austral. For.* 3, 1938 (24–7).

The growth of *Pinus radiata* suffering from a rosette-forming disorder in Western Australia was stimulated to a marked degree by zinc chloride. Manganese sulphate, ferrous sulphate, cobalt chloride, nickel chloride, sodium molybdate, and boracic acid also stimulated growth, but further damage was caused by some of these salts, notably by those of nickel, cobalt, and copper. Observation over a long period of the growth of Pines on the soil type in question suggest that the rosette disorder is not due to soil deficiency, but to inability of the trees to take up the elements under certain conditions.

12.14. Morphology. Anatomy

12.14.3 : 12.25.53 : 21 (43.1). WAGENHOFF, A. **Investigations into the development of the root-system of Pine on diluvial sandy soils.** *Zeitschr. F. & J.* 70, 1938 (449–94). [G.g.]

In Eberswalde and Finowtal, in the years 1934–6, the author examined the root-systems of 5 trees of Scots Pine between the ages of 46 and 196 years growing under very similar conditions. The root-systems were very carefully measured, analysed by ring-counting and micro-anatomy, plotted on diagrams, and photographed. The paper contains 17 detailed diagrams and photographs and 6 root-analysis tables.

The rather irregularly distributed and often one-sided root-systems reached their maximum of development in the early pole stages; in close stands on deep sandy soils, free from weed growth, the side-roots were 12–16 m. long and spread up to 10–14 m. from the stem, a distance 4 to 5 times as great as the spread of the crowns at that age. Most of the side-roots were very superficial, remaining usually within 30 cm. of

the surface, and tended to branch near the extremities. At the age of 40 the tap-roots reached a depth of up to 4·50 m. Soon after the main side-roots had developed to their maximum length, they began to die off from the tops and were replaced by side-roots of a higher order, which, after some time, began to die off in their turn. The paper also contains some subsidiary observations on root-anatomy.

12.14.3 : 21 (56.9). OPPENHEIMER, H. R. **Studies in the root-development of several Mediterranean plants.** *Bulletin de la Silva Mediterranea* 10, 1935 (142–62). [F.f.]

A description is given of a simple and inexpensive subterranean gallery used in the University of Jerusalem for the study of the early stages of development of the root-system of forest trees, and especially of those species that form a tap-root. The gallery consists principally of a series of boxes of varying length fitted with windows to allow observation of the roots and the soil inside. Since the construction of the gallery in 1930, the species of Pine and Oak considered most important for afforestation work in Palestine have been studied by means of the device. It was found *inter alia* that April and June were the months in which Oak plants showed the fastest rate of growth: at that, the growth of their roots rarely exceeded one centimetre a day. In the first year the roots penetrated to a depth of 60–80 cm. and in the second to a depth of 140 cm. The paper gives little information on the root-development of the Aleppo Pine, which is mentioned as having been dealt with in a paper by the author in *Gartenbauwissenschaft*, No. 7, 1933, pp. 308–64. A few notes are given on the root-development of Vine, of *Cercis siliquastrum*, and of *Retama roetam*, as ascertained from study of these species with the same apparatus.

12.14.4 : 12.27.57. STOATE, T. N., and WALLACE, W. R. **Crown Studies of Jarrah saplings, 1928–38: a progress report, with photographic record, of various stages in development of Jarrah sapling crowns.** *Austral. For.* 3, 1938 (64–73).

For the purposes of this study 'perfect' sapling crowns of Jarrah are distinguished from those with 'persistent' side branches. The 'perfect' crown consists typically of the leafy branches of 4 successive years, since after 4 seasons the leaves fall and the branches soon die back and are shed, leaving a scarred but otherwise clean bole. As a result of this process the sapling crown undergoes vertical displacement rather than lateral extension, remaining much the same until the main crown division into adult branches takes place. For the same reason depth of crown is determined, after the initial stages, by height growth and bears no constant relation to the total height. Three classes of crown are recognized, differing in height growth and depth of crown. The so-called 'perfect' crown is comparatively rare: more often, especially after a girth of 17 in. has been attained, 'persistent' side branches occur. These are juvenile branches which are ultimately shed, but which persist for as long as 10 years. There is no evidence that small 'persistent' branches are a serious defect, nor that they materially affect the quality of the final log from the adult tree; on the contrary they may exert a beneficial effect by accelerating girth increment. The authors consider it likely that such branches could be avoided only by keeping the stand dense, probably at an unjustifiable sacrifice of girth increment in the small pole stage. They suggest that good silvicultural practice may eventually recognize three developmental stages in Jarrah: a young pole stage with juvenile branches only, a small pole stage in which 'persistent' side branches occur, and the mature stage following the main crown division. Detailed data on crown development are embodied in graphs.

12.15. Mode of life. Adaptability

12.15.2 : 12.11.2 : 12.25.56. HÄRDTL, H. **The influence of the weight of stem and branches of a conifer on the habit of growth.** *Forstw. Centralbl.* 60, 1938 (373–52, 424–9). [G.]

The author determined the form, weight, leverage, and total length of stem and branches of a low-branched *Pseudotsuga douglasii* in a free position. As the effect of the weight of the different parts of the tree alone was far too small to account for the relatively high resistance to compression of the stem, he attempted to estimate the sum of the pressures exerted by the branches, considering the latter as cantilevers with supported ends. Although the result was only a fraction of the actual resistance to compression of the stem, it was many times higher than the figure obtained from the calculation of the weight alone. He points out that the resistance of the stem to compression is affected

by external factors such as wind, snow, &c., and that environmental influences may be accountable for the stem-form of individual trees within a forest.

12.19. Geographical distribution. Plant Geography and Sociology

12.19 (54.2). Mooney, H. F. **A synecological study of the forests of Western Singhbhum, with special reference to their geology.** *Indian Forest Records* (N.S.). Silviculture 2, No. 7, 1938. pp. 259–356.

A preliminary ecological study of the forests of Western Singhbhum, which include some of the most valuable Sal forest in the province of Bihar. Natural and biotic factors are described, important features being the varied topography, the numerous geological formations, and the relative lack of interference by man. Climatic variations in the area are comparatively small and emphasis is laid on geology and soils as the major factors determining the occurrence of the various types of vegetation. The forest vegetation is divided into 12 types, which are described and discussed in detail. The ecological status of the types and their relation to the climatic climax are also examined and a final chapter is devoted to secondary succession and the probable course of succession in some of the more important subseres.

12.19 (54.2). Bor, N. L. **The vegetation of the Nilgiris.** *Ind. For.* 64, 1938 (600–9).

Discussing Ranganathan's recent paper on the vegetation of the Nilgiris, the author expresses his belief that the *shola* forest is the relict of an evergreen forest climax pushed back by fire and grazing. According to this view the grassland would be a biotic climax. The limitation of *shola* by ground frost is regarded as an effect of lack of cover, which in a seral progression might be afforded by frost-hardy nurse species. The sharp transition from *shola* to grassland only serves to emphasize that both cannot be climatic climaxes, and since the region as a whole experiences a 'forest' climate, *shola* is the more likely to be the true climatic climax.

12.19 (54.2). Ranganathan, C. R. **Studies in the ecology of the Shola grassland vegetation of the Nilgiri plateau.** *Ind. For.* 64, 1938 (523–41).

The natural vegetation of the Nilgiri plateau is temperate evergreen forest (*shola*) and grassland. The extensive areas of grass are almost confined to the western plateau, which is subject to ground frost, and in this region the *shola* is reduced to small patches of woodland in the hollows on the slopes. Fringing forest is absent in the frost zone. *Shola* is said to be the forest climax, and the grassland is also considered as a natural climax.

12.19 (67.8). Pitt-Schenkel, C. J. W. **Some important communities of warm temperate rain forest at Magamba, West Usambara, Tanganyika Territory.** *Jnl. Ecol.* 26, 1938 (50–81).

This study is based on a 10 per cent. strip survey of the Magamba forest. Field methods and factors of the habitat are described, and reasons given for selecting the term 'warm temperate rain forest'. The author recognizes a hydrosere and a xerosere, with two subseres, edaphic and biotic. An account is given of the main communities, and in describing these the vegetation is divided up into 4 stories. Suggestions are made on the possible rank and ecological relationships of the various communities; the author's conclusions on these points are embodied in a diagram illustrating successional relationships. Finally, the theory of forest types is discussed briefly and it is suggested that the chief communities recognized might be regarded as forest types.

12.19 (71). Halliday, W. E. D. **A forest classification for Canada.** *Jnl. For.* 36, 1938 (1055–61).

A general outline is given of the forest regions of Canada. Eight types are recognized, corresponding in the main with Clements's climax formations of North America. The forest regions are further divided into forest sections. Much work remains to be done on the accurate definition and demarcation of the units, and a particular feature of the more detailed work will be the supplementing of the broad classification by forest site types distinguished on an ecological basis.

12.19 : 09.7 (43.77). Zlatník, A. **An ecological study of the Stuzica, Javorník, and Pop Ivan nature reserves.** *Sborník Vyzkumných Ústavů Zemedelskych CSR.* No. 152, 1938 (6–437). [Cz.g.]

Provisional results are given of studies carried out by the author in Carpatho-Russian forests mainly to ascertain the degree of reliability of

ground vegetation as an indicator of site quality. The different types of soil appeared to be determined essentially by the character of the parent rock. Fagion soils belonged to the Brown earth, Piceion soils to the podsol series, while more or less pronounced gley soils had their own characteristic plant communities. Differences in the chemical and the permanent physical properties of Piceion and Fagion soils were not such as to point with any degree of certainty to their being due to the different composition of the tree vegetation. So far, the characteristic features of the smaller ecological units and of the tree growth seemed to depend mainly on climatic and edaphic factors, particularly soil humidity and soil aeration. The composition of mixtures of tree species varied within the same forest type; thus the *Asperula* type consisted in some plots of pure Beech, in others of Fir and Beech or of Fir, Beech, and Spruce. Nor did a species necessarily reach its maximum height development within the forest type or sub-type in which it was most dominant. Thus the tallest Spruce was found in some plots of the *Lonicera-Spiraea* type where Spruce formed only 39 per cent. of the mixture, while in the pure Spruce forests of the *Myrtillus-Musci* type, where vitality and reproductive ability were at their best, height-growth was much lower. The researches in the *Fagetum nudum*, *Asperula*, *Lonicera-Spiraea*, *Myrtillus-Musci*, *Rubus hirtus*, *Calamagrostis*, *Filices*, and *Luzula silvatica* types showed, in a general way, that a correlation exists between the maximum height reached by the different species and the forest type, though not between the forest type and the standing volume nor between the average height of the stands and their total basal areas per hectare.

On the whole, it was concluded that the character of the plant community of a forest indicates the nature of the locality much better than does the soil, since the climatic factor seems to express itself less markedly in the latter than in the composition of the vegetation.

12.19 : 09.7 : 12.25.52 (497.1). VAJDA, E. **The natural distribution of Spruce in the 'Gross-Kapela' region (Jugoslavia).** *Zeitschr. F. & J.* 70, 1938 (539–51). [G.]

The study of data from over 400 pure and mixed stands of Spruce in Gross-Kapela (Northern Dinaric Alps) showed that the maximum and optimum occurrence of Spruce corresponded to elevations of 600–800 m.; undulating topography, eastern and western aspects, and protected basins being placed in descending order of preference. Southern slopes are unfavourable, due to isolation and hot southern winds, and so are north-eastern aspects at higher elevations because of the drying effect of the Bura or north-wind. Altitudes above 1,200 m. were as a rule occupied by pure Beech, this being ascribed to the warm and moist south winds, which keep the average winter temperature of seaward slopes and of all high elevations at about 0° C. as compared with −3° C. in regions below an altitude of 1,000 m.

The factors limiting the distribution of Spruce were further concluded to be as follows: a minimum rainfall from May to August of 400–600 mm., provided drought years occur on the average not more than once in four years; a maximum saturation deficit (i.e. average saturation deficit of the air in the driest month at 2·0 p.m.) of 10 mm.; a maximum average temperature for January and February of −1° C. The author also believes the Spruce of the region studied to have a high light requirement, since in one undisturbed pure Spruce stand diameter frequencies show a binomial distribution. Spruce occupied roughly 20 per cent. of the total forest area of Gross-Kapela.

12.19 : 09.7 : 12.25.53 (498.3). CZOPPELT, H. **The natural distribution of Scots Pine in the forest of Brosteni.** *Revista Padurilor.* 50, 1938 (765–79). [Rou.g.]

The Brosteni forest (40,000 ha.) is situated in the north-west corner of Moldavia at elevations between 1,500–1,600 and 620 m. The upper part consists mainly of *Picea excelsa* and *Abies pectinata*, the lower of Beech. Scots Pine (including the varieties var. *genuina* Heer f. *gibba* Christ, var. *parvifolia* Heer and others) is found only in the rockiest parts of the forest. Out of 30 stands which are shown on a map annexed to the paper, 17 are on crystalline shale and 13 on chalk soils. The form and growth of the trees depend essentially on soil conditions, and, generally speaking, the rockier the soil, the more tapering are the stems and the more spreading the crowns. The percentage of straight cylindrical stems with narrow crowns increases with the degree of decomposition of the soil.

12.19 : 09.7 (54.1). BOR, N. L. **A sketch of the vegetation of the Aka Hills, Assam. A synecological study.** *Ind. For. Rec.* (B) 1, 1938 (103–221).

The vegetation of the Aka Hills is described

from a synecological standpoint, taking as the basis of nomenclature the system put forward by the American plant ecologist F. E. Clements. After a preliminary descriptive survey of the area under discussion, the biotic factors are outlined, and the various vegetational units are grouped into climax and seral communities. The special relations existing between vegetation and water in quantity are discussed in a chapter 'Hydroseral Communities'. The profound effect of the activities of Man upon vegetation, whether it be climax or seral, is demonstrated in chapters dealing with grazing, grasslands, and vegetation in the vicinity of habitations. An appendix is added with the object of correlating the views of the writer and those of Champion in his *Preliminary Survey of the Forest Types of India and Burma. From author's abstract.*

12.19 : 09.7 : 12.27.57 (922). STEENIS, C. G. G. J. VAN. **The *Melaleuca* grove in the Angké Forest Reserve, Batavia.** *Tectona* 31, 1938 (889–901). [Du.e.]

The situation and ecology is described of a pure grove of *Melaleuca leucodendron* of *c.* 5 hectares, found by the author in Angké Forest Reserve near Batavia: the first *Melaleuca* observed in Java. The ecology of this species in Malaya is discussed, and it is pointed out that a careful systematic study of the Malaysian and Australian species and varieties is desirable in view of the importance of particular varieties yielding commercial oil.

12.19 : 11.2 (4). GAUSSEN, H. **Climates, climaxes, and zones of vegetation.** *Reprint* from the *Boletim da Societade Broteriana*, Series 2, 1938. José de Oliveira Júnior, Alcobaca.—Chiefly concerned with Mediterranean and Alpine vegetation zones. pp. 29–40. [F.]

The question of the terminology to be applied to mountain climates is discussed. The respective usefulness of general terms such as 'temperate', 'mountainous', 'subalpine', &c., and those that classify the climatic stories by their natural forest vegetation climaxes is compared. A terminology of the latter type is given for the climatic stories of the mountains of south-western Europe.

12.19 : 12.27.72 (729.3). CIFERRI, R. Studi sull' ecologia del Mogano [*Swietenia Mahagoni* Jacq.] in San Domingo. [**Studies on the ecology of the Mahogany tree in San Domingo.**] *Reprint* from *Atti dell' Istituto Botanico dell'Universita di Pavia*, Serie IV, 4, 1933 (37–166). [It. latin.]

The ecology of the species, conditions for its natural regeneration, and measures for protection and afforestation in the Dominican Republic are discussed. The stocking of Mahogany trees of 5 m. in height and over is estimated at 4 stems per hectare. Mahogany is almost entirely confined to the mesophytic zone.

12.19 : 23.2 : 12.28.35 (91). KOOPMAN, M. J. F., and VERHOEF, L. ***Eusideroxylon zwageri*, the Iron-wood of Borneo and Sumatra.** *Tectona.* 31, 1938 (381–99). [Du.e.]

A general account of the distribution, natural and artificial regeneration, and wood of *Eusideroxylon zwageri* T. & B.

12.19 : 56 : 64 (71.4). SISAM, J. W. B. **The correlation of tree species and growth with site-types.** *Canadian Forests Branch Silvicultural Research Note* No. 53. Ottawa. 1938. pp. 20.

A visit was made to the Lake Edward Experimental Area, Quebec, with the chief objects of studying the relation of increment to site types, and of determining the value of site types in the subdivision of an area into management units. Differences were recorded in the increment of forest trees on the several site types and are adjudged sufficient to serve as a basis for correlating site type with site quality. In regard to management it is suggested that the ground vegetation reaches stability far more quickly than the forest, and may thus be used as an indicator when considering the future treatment of felled areas. In the Lake Edward region the majority of cuttings have been insufficient to upset the ecological balance, and the stable cover types are still recognizable; but even here the ground-vegetation types are in some cases more easily distinguishable by eye than the corresponding cover types.

12.19 : 64. COILE, T. S. **Classification of forest sites with special reference to ground vegetation.** *Jnl. For.* 36, 1938 (1062–6).

The author criticizes two assumptions on which Cajander's theory of forest types is based: firstly, that the ground vegetation is a more reliable and more constant index of inherent site quality than the forest cover, and, secondly, that ground vegetation is largely independent

of the composition, age, and density of the forest. After a discussion of reasons for questioning these assumptions, it is suggested that a site classification based on the more fundamental features of the soil and the relative topographical position of the soil mass should provide a better index to the inherent growth capacity of the land.

12.2. *Special (Systematic) Botany*

12.25.5 : 23.26 : 23.24 (922). JONG, B. de. **Plantations of *Agathis dammara*.** *Tectona* 31, 1938 (248–73).

Agathis alba Foxw. (A. dammara *Rich.*) is said to be a promising species for timber production on rather steep slopes in Java. Present experience is insufficient to establish definite rules for the cultivation of this species, but the author finds it possible to make certain preliminary recommendations on the raising of seedling stock in nurseries and on planting-out practice.

12.26.51 : 33.32 (67). POLCHAU, W. **The Umbrella tree, *Musanga smithii* R. Br.** *Kolonialforstliche Mitteilungen* 1, 1938 (185–221). [G.]

The paper consists principally of a comprehensive summary of existing literature on the subject, reviewed in the light of the author's own observations as participant in Professor Heske's expedition through the forests of the Gulf of Guinea in the winter of 1936–7. The last summary of this kind was published in 1925: NOACHOWITCH *et al.* Parasolier et papier de Parasolier. Paris, Bibl. de l'Inst. Nat. d'Agron. Col.

The author observed the remarkable adaptability of the Umbrella tree to a wide range of soil conditions, varying from the poorest types of laterite and sand to the most fertile volcanic and alluvial soils. In the conditions obtaining in the Cameroons, the tree is said to require a minimum annual rainfall of approximately 1,500 mm. On the other hand, the author believes that the very high rainfall of the mountains of the Northern Cameroons makes it more difficult for the Umbrella tree to compete successfully with other forest species, and that this is one of the main reasons why the Umbrella tree is more frequent and widely distributed in the drier conditions of the Southern Cameroons. The increment of the stands is believed to vary with site conditions, but, as a provisional rough figure, a mean annual increment of 30 cu. m. true volume per ha. of wood 7 cm. or more in diameter (Derbholz) is assumed, on the basis of the author's own observations and the measurement of one sample plot by Grünwoldt, another member of the expedition.

It is stressed as important that, as the Umbrella tree is a light demander typical of the secondary forest, many millions of cubic metres are readily available in the more accessible regions, where exploitation for pulpwood could begin. The paper contains some photographic material from the expedition and a very rough sketch showing the distribution of the Umbrella tree in Africa.

12.27.48 : 12.15 (69). RIGOTARD, M. **A forest species worth propagating, the Mountain Tamarind (*Acacia heterophylla* W.)**—notes on germination and rates of growth. *Revue Internationale du Bois* 5, No. 53, 1938 (161–5). [F.]

The species discussed, of which a botanical description by the same author appeared in the *Revue de Eaux et Forêts* of March 1925, grows in the mountains of the Ile de Réunion in localities sheltered from the wet east and south-east winds. The Tamarind forests persist up to altitudes of between 1,500 and 2,000 metres *a.s.l.* So far there has been no close study of the site conditions required by the tree nor of its rate of growth. It is suggested that the species should be tried for the afforestation of tropical mountain regions protected from wet winds, as its good qualities for turnery and constructional work justify the experiment.

12.28.71 : 12.19 (922). VERHOEF, L. De boomsorten behoorende tot het geslacht *Adina* **[The tree species of the genus *Adina*].** *Korte Mededeelingen van het Boschbouwproefstation* No. 66. 1938. pp. 14. Appeared also in *Tectona* 31, 1938. [Du.e.]

The four species of *Adina* found in the Dutch East Indies, i.e. *Adina minutiflora* Val. = *A. rubescens* Hemsl., *A. polycephala* Benth., *A. fagifolia* Val., and *A. spec. dub.* ('Nessatus' of Rumphius), are described.

12.29.51 (54.1). BOR, N. L. **A list of the grasses of Assam.** *Ind. For. Rec.* (B) 1, 1938 (47–102).

A list of the grasses so far known to inhabit Assam. Six grasses new to science, viz. *Sclerostachya milroyi*, *Themeda huttonensis*, *Rottboellia goalparensis*, *Deyeuxia nagarum*, *Ischaemum hubbardii*, *Hyparrhenia griffithii*, are described, and 5 of them are figured. The following new combinations have been made: *Melictotrichon*

asperum Bor, *Arundinella griffithiana* Bor, *Acroceras tonkinense* (Bal.) Hubbard mss., *Microstegium petiolare* Bor, *Cymbopogon khasianus* Stapf. mss., *C. hookeri* Stapf. mss., *Schizachryium delavayi* Bor. The modern names of the species have been given, together with the synonym as it appears in Hooker's *Flora of British India*. The type sheets of the new species are preserved in the herbarium of the Forest Research Institute, Dehra Dun. *Author's abstract.*

13. *Forest Zoology*

13.21.85.3. BURGEON, L. **Notes on the termites.** *Bull. cercle zool. congo.* [bound with *Rev. zool. et bot. afr.* 31, 3–4] 15, 1938 (101–4). [F.]

The paper contains short notes on a young colony of *Termes natalensis*, on *Thaumatoxena*, and on the nests of *Acanthotermes* and *Cubitermes*.

13.21.85.8 : 13.14 (54). GARDNER, J. C. M. **Immature stages of Indian Lepidoptera (1), *Lymantriidae*.** *Ind. For. Rec.* (E) 3, 1938 (187–212).

Larvae of several species belonging to the genera *Lymantria*, *Dasychira*, *Orgyia*, *Laelia*, *Redoa*, *Stilpnotia*, *Caviria*, *Perina*, and *Euproctis* are described, with keys. *Author's abstract.*

2. SILVICULTURE

2 (91). STRUGNELL, E. J. **Silviculture in Malaya.** *Emp. For. Jnl.* 17, 1938 (188–94).

The sequence of fellings, girdlings, and cleanings used in the regeneration of Malayan evergreen forest is discussed. The influence of the increasing use of sawmills on this sequence, and the use of frill girdles poisoned with sodium arsenite for disposing of unwanted trees, are also described. *Author's summary.*

2 : 07.2 (71). KOROLEFF, A. **Silviculture in relation to logging.** *Jnl. For.* 36, 1938 (957–61).

A plea is made for the encouragement of silvicultural research and dissemination of silvicultural knowledge in Canada. By this means regeneration and cutting methods might be brought on to a more satisfactory footing. Among other measures, the author envisages the establishment of a Silvicultural Research Bureau for the advancement and co-ordination of knowledge in this field.

2 : 12.1 : 12.25.54 (41). LAING, E. V. **European Larch (*Larix decidua* Mill.) and its susceptibility to losses in planting.** *Scot. For. Jnl.* 52, 1938 (41–68).

From experiments indoors and in the field the author concludes that root extension in European Larch lags behind flushing for a variable, often protracted, period. Transpiration therefore begins before the roots are functioning properly, and transplanting aggravates the trouble by destroying some of the root-tips. Under such conditions spring drought is a great danger to plantations. In dry sites ditch planting has proved a successful measure. Various ways of reducing the lag were tried out, including couching and shading of the transplants, which appears to give promising results. It was observed that plants raised from Scottish seed were more resistant to drought injury than those of foreign provenance, and since there are several races of Larch in Scotland, probably distinguishable botanically, the question of seed origin deserves much more attention.

21. *Silvicultural characters*

21 : 12.15 : 12.25.53 (68). SHERRY, S. P. **The rate of growth and health of the Southern Pines in the Midland Conservancy.** *Jnl. S.A. For. Assn.* 1, 1938 (30–40).

Pinus taeda requires light, moist soils rich in humus, and on such sites *P. insignis* (*radiata*) will yield a greater volume of timber of better quality. *P. caribaea* and *P. palustris* are tolerant on a wide range of sites. While the latter species is unprofitable because of its extremely slow growth, the former is to be recommended for the afforestation of badly drained soils.

21 : 12.28.61 (54.5). CHOPRA, R. S. **The Indian Olive (*Olea cuspidata*, Wall).** *Punjab Forest Records* 1, No. 5, 1937. Lahore. pp. 30.

Olea cuspidata is the most important tree of the subtropical dry evergreen forest of the Western Himalayan foot-hills, being valued for its general utility and the efficient protection it affords to the soil. The hard and durable wood is used for a variety of purposes and makes

excellent fuel; the leaves are prized for cattle fodder; and although the fruits are of poor quality, the tree makes a good stock on which European Olive may be grafted. Part I of the paper deals with its general silviculture: botanical and silvicultural characters are discussed, statistics given of growth and yield, and diseases and injuries described. The question of propagation receives much attention, and it is concluded that the best method of forming plantations is by transplanting 2-year-old nursery seedlings. Pre-treatment of the seed is recommended to hasten germination. Part II is concerned with the growing of the tree as a fruit crop.

21 : 23.2 : 12.19 : 12.27.48 (54.5). CHOPRA, R. S. **Phulahi (*Acacia modesta*, Wall).** *Punjab Forestry Notes* No. 3. 1937, Lahore. pp. 11.

An account of the distribution, habitat, and silvicultural characters of Phulahi. The tree is useful for several reasons: it is extremely resistant to drought and frost, yields good fuel and fodder, and is an excellent nurse for Olive (*Olea cuspidata*). Natural regeneration is unsatisfactory. Artificial regeneration can be effected by stump or branch cuttings, but direct sowing in the rainy season is considered by far the most suitable method of establishing plantations. Germination is hastened by soaking in cold or hot water, but chemicals tend to damage the seed. Germination tests and injuries and pests of the tree are briefly described.

21 : 23.3 : 12.28.47 (729). BROOKS, R. L. **Notes on the growing of Teak (*Tectona grandis* Linn.) in Trinidad.** *Trinidad Forest Dept. Leaflet* No. 7. 1938. pp. 14.

Contains an account of Teak in its natural habitat and in Trinidad, with notes on silvicultural characters and requirements, formation and tending of stands, and utilization. Statistics are given for the Trinidad plantations. The tree was first introduced from Burma in 1913 and 1915, and successful plantations were made; and by 1920 good viable seed was being collected. At present the pure Teak plantations of the Forest Department occupy about 1,500 acres of 1–24 years in age. Since 1928 an average of 140 acres a year has been planted. The first stands were formed by direct sowing, but this method has given way to *taungya* plantation. Teak has proved very successful in Trinidad and has not suffered from diseases or pests. Yield tables are given for comparison with those of the Indian plantations at Nilambur, and it is suggested that the average yield of Trinidad Teak will be half-way between Qualities I and II at Nilambur.

21.2 : 12.19 (75.6). KORSTIAN, C. F., and COILE, T. S. **Plant competition in forest stands.** Durham, North Carolina. *Duke University School of Forestry Bull.* 3. 1938. pp. 125.

Trenching experiments in the Duke Forest, in 7 sets of trenched plots with Pine, Oak, and Poplar species between 9 and 42 years of age growing mainly on loamy soils, showed that competition for soil moisture between individual components of the forest vegetation is a highly significant factor in the growth, development, and regeneration of forests on the Piedmont plateau. No significant differences between the trenched plots and the controls could be detected by means of light intensity measurements and chemical soil analysis. The paper contains very detailed vegetation charts and stem-and-crown projection maps, and much photographic material.

21.3 : 11.47 : 12.25.53 (941). KESSELL, S. L., and STOATE, J. N. **Pine nutrition.** *Western Australia, Forests Department Bulletin* No. 50. 1938.—An account of investigations and experiments in connexion with the growth of exotic conifers in Western Australian plantations. pp. 45.

Considerable research has been done in Western Australia on the irregular and abnormal growth of *Pinus radiata* and *P. pinaster* in certain areas, with a view to discovering remedial measures and avoiding unsuitable sites in the future. The present bulletin is a progress report on the investigations. The various types of abnormality are described, and an account is given of geology, soils, and other factors possibly concerned. On virgin soils it has been possible to establish a close correlation between soil type and tree growth, but on disturbed soils anomalies occur. The physical properties of the soils appear to be of minor importance, but the greatest significance is attached to soil fertility and the availability of plant nutrients. Corrective treatments are discussed and described, the most important large-scale measures being cultivation, dressings of superphosphate, and the spraying of seedling Pines with solutions of zinc salts.

22. *Systems of Management. Forms of Stand*

22 : 21 : (43.1). WITTICH, W. **The present silvicultural organization in the Prussian State forests with special reference to the separation of different habitat types.** *Forstarchiv* 14, 1938 (185–93). [G.g.]

Over large areas of the Prussian State forests a provisional classification of habitat types is needed to enable the different types of timber required for the purposes of the national economy to be produced in the localities best suited to each. This classification is to be based mainly on forest types, and an attempt is to be made to correlate these with the corresponding types of habitat in accordance with instructions to be issued locally.

22.1 : 7 : 5 : 12.25.53 (43.4). BAADER, G. **The significance of Pine woods managed on the high-forest-with-standards system in relation to economics, yield, and silviculture.** *Deutscher Forstv. Jahresb.* 1937 (243–57). [G.]

Sample plots were made in the Eberstadt forest near Darmstadt to study the growth conditions in Pine woods managed under the high-forest-with-standards system. The area affected by the shade of the crowns of the standards was equal to 7–8 times the area occupied by the crowns themselves in the case of young stands, and not more than 1·5 times in stands of 65 years and over. The negative effect on height growth was most pronounced in the earlier, and gradually disappeared in the later stages. Although the woods managed under the high-forest-with-standard system produced a somewhat smaller total volume of timber than similar stands under the uniform system, the author prefers the former system because it means a larger timber reserve and higher interest on the capital value of the forest.

22.1 : 23 : 12.27–28 (91). WALKER, F. S. **Regeneration of Klang Mangroves.** *Mal. For.* 7, 1938 (71–6).

Until 1932 the silvicultural treatment of the Klang Mangrove forest in Malaya alternated with little success between modifications of the high-forest-with-standards and the shelterwood systems. In the present system a regeneration thinning just heavy enough to secure advance growth is carried out 4 years before the final felling, which is a clear cut. Natural regeneration is often small, but since most of it is under 3 ft. high at the final felling it suffers little from felling damage. To supplement natural regeneration, large-scale planting is done within two years of the final felling. Planting operations have been successful, and their cost is regarded as justified. The indigenous species of Mangrove are discussed and suggestions made on the choice of species for planting. *Rhizophora mucronata* and *R. conjugata* have already proved successful; the only other species showing promise is *Ceriops candolleana*. The article concludes with a brief note on planting methods and organization.

22.14. HAUSRATH, H. **The selection-forest problem.** *Allg. F. & J.* 114, 1938 (305–18). [G.]

This is essentially a survey of existing knowledge of the selection forest problem, and of opinions held with regard to it. Reference is made to 119 papers, which are listed in a bibliography.

22.14 (494). AMMON, W. **The selection principle in Swiss forestry. The results of 30 years' management of selection forests.** *Supplement No. 17 to Zeitschrift des Schweizerischen Forstvereins.* 1937. pp. 108. [G.]

This is a synthesis of the author's papers on the selection system published in the *Schweizerische Zeitschrift für Forstwirtschaft* since 1915. It deals with the various aspects of selection forestry, such as the history of the selection idea and its recent revival; an explanation of what is meant by the selection principle; the differences between the selection system and the Swiss Femelschlag; the main tree species of Switzerland in their relation to selection forestry; the structure, development, management, and profitableness of selection forests, and so on. The paper is illustrated with some very fine photographs of the forests in which the author has had practical experience for over 30 years.

He points out that selection forests should not be confined to sites of good quality; that the selection system is suitable for all species or races native to the locality; and that whereas species and races from similar localities may be used as subsidiary constituents of mixtures, those native to entirely different sites should not be included as they do not regenerate naturally and cannot be raised without very intensive cultural work to free them from competition.

Although the author believes that high forests managed under selection produce a larger volume of timber than under any other silvi-

cultural system, he does not attempt to prove this; but endeavours to show that, assuming equal volume production under selection forestry and 'exploitation' forestry[1] the former is more profitable under comparable conditions. The following are the main lines of the argument as put forward in Chapter V of the paper:

The selection system does not involve higher costs of management. Since selection forests contain a relatively low percentage of small-sized material, less money need be spent on tending young growth and on thinnings. Marking of fellings, felling and logging, contrary to widespread belief, also require less labour. To prove this, Ammon works out a theoretical example comparing the normal yield under the clear-cutting and the selection system respectively (on the assumption that the selection forest is of the Emmental type), in areas of 120 ha. with a total volume production of 1,430 cu. m. each. The crop consists of Quality III mountain Spruce worked, in the case of the clear-cutting system, on a rotation of 120 years; and the total annual yield under this system, calculated from Flury's yield tables, amounts to 10,200 trees from a felling and thinning area of 21 ha., the average size of the trees felled and thinned being 0·140 cu. m. In the area managed under the selection system the yield is obtained from 1,430 trees only on 12 ha., the average size of trees felled being 1 cu. m. Ammon assumes a felling cycle of 10 years, as commonly practised in Emmental. Thus the clear-cutting system compares unfavourably with the selection system, since the former involves the felling of 7 times as many trees on twice the area for the harvesting of the same volume. The author admits that selection forestry requires higher skill in management, but claims that this is more than counterbalanced by the larger amount of labour involved in clear-cutting systems. This example brings out the fact that the normal yield under the clear-cutting system consists of many more trees; it is also essential to note that the maxima and the approximate Modes of the bell-shaped volume distribution curves (volume of yield obtained from 120 ha./diam. classes) correspond roughly to the 30 cm. and the 50 cm. diam. classes under the clear-cutting and the selection system respectively. On the other hand, the maximum of the price-size-graph as constructed by Ammon also coincides approximately with the 50 cm. diam. class. The author calculates for the above example a total net annual value production in Swiss francs of 21,700 under the clear-cutting and 34,100 under the selection system respectively—an approximate ratio of 100: 157; the average net value/theoretical cu. m. being 15·17 *Fr. Sw.* in the former case and 23·84 *Fr. Sw.* in the latter. The calculations are admittedly rather rough and rest in part on purely theoretical assumptions; so they are supplemented by a detailed account of the expenditure, yield, income, and changes in capital value of the Steffisburg selection forest during the period 1914–34, which shows the theoretical calculations to be fairly correct in actual practice.

22.56 : 23.23.3 (54.2). SMYTHIES, E. A. **The taungya plantations of Bhinga, Bahraich Division, U.P.** *United Provinces Forest Department Bulletin* No. 13. 1938. pp. 9.

The Bhinga range (about 38,000 acres) consisted of severely over-grazed and dying forest before the introduction of *taungya* operations in 1934. These have proved a complete success and are now progressing at a rate of 400 acres a year. The range has been divided into two working-circles: an inner one of 16,500 acres primarily for the production of Sal and other valuable species for revenue, and an outer working-circle of 21,500 acres reserved primarily for the requirements of the villagers in respect of grazing, small timber, &c. Both working-circles are to be regenerated by *taungya* as far as possible, land being given out on condition that tree seeds are sown in the second *kharif*. Under this system, revenue from timber has already more than doubled and the villagers have become much more prosperous. The technique developed in the Bhinga *taungyas* should be applicable in the creation of village fuel and fodder plantations in the plains districts.

22.56 (54.2). SMYTHIES, E. A. **The taungya plantations of Bhinga, Bahraich Division, U.P.** *Ind. For.* 64, 1938 (471–82).

The forest of Bhinga had fallen into a derelict condition owing to long-continued over-grazing and removal of small poles. A working plan was put into operation in 1935–6 and the whole area is being successfully regenerated by *taungya*

[1] *Abtriebswirtschaft*, a system characterized by definite final fellings, and including all high-forest systems in which felling and regeneration are concentrated at any one time on only part of the forest area.

plantation. With the co-operation of the villagers, the forestry staff are clear-felling 400 acres a year and restocking with valuable fuel and fodder species. The technique is effective and cheap to apply, and the results are wholly satisfactory.

22.6 : 12.25.54. BARBEY, A. **The cultivation of Larch in coppice under conversion.** *Jnl. for. suisse* 89, 1938 (202–5).

The use of stakes is advocated for young Larch trees up to 1·50–2 m. in height to prevent curving near the base under the lateral influence of shrubs, &c.: a phenomenon frequently observed where Larch is planted in coppice undergoing conversion. Where not more than 200–250 trees are planted to a hectare the expense involved is small.

22.81. FEKETE, *Z.* **The right interpretation of stock- and crown-density.** *Erdészeti Lapok* 77, 1938 (841–50). [Hu. g.f.e.]

Stress is laid upon the distinction between stock- and crown-density. The latter is much easier to determine and is usually substituted for the former in the practical application of yield tables. The author's personal experience suggests that this substitution leads to no serious inaccuracies with Beech and Hornbeam, but is inadmissible in the case of Locust and Oak. For these two species tables have been constructed that enable the crown density factor to be converted into the appropriate stock density factor for each of 6 site classes. The author advocates the construction of similar tables for other species wherever required.

22.83 (47.1). LAPPI-SEPPÄLÄ, M. **The raising of mixed stands.** *Silva Fenn.* 46, 1938 (132–44 and 241). [Fi.g.]

Mixed stands are of great importance in Finnish forestry. They usually occur on good soils, the most frequent and important mixtures being Pine-Spruce and Birch-Spruce. Investigations on mixed stands of Pine-Birch have shown that the presence of a certain proportion of Birch has the effect of raising the increment of Pine. The admixture of Spruce in Pine-Birch stands is also advantageous from many points of view. Mixtures occurring naturally should not be converted to pure stands without adequate reason.

23. *Formation of Stands*

23 : 12.25.56 (75.3). ISAAC, L. A. **Factors affecting establishment of Douglas Fir seedlings.** *U.S. Dept. of Agric. Circular* No. 486, 1938. pp. 45.

The investigations were carried out near Carson, Washington. It was found that slash fires increased seedling losses from two principal causes—heat and drought. Forms of compromise between fire-protective and silvicultural requirements are discussed.

23 : 24 : 12.25.52 (74). WESTVELD, M. **Silvicultural treatment of Spruce stands in north-eastern United States.** *Jnl. For.* 36, 1938 (944–50).

This paper describes a scheme of silviculture designed to maintain the productiveness of Spruce forests. Management should aim at securing proper reproduction before heavy cuttings, at freeing Spruce and Fir regeneration from hardwood competition, and at reducing logging damage. Efforts to favour Spruce and Fir at the expense of hardwoods are expected to be amply repaid by greatly increased yields.

23.1. Natural formation of stands

23.1 : 12.25.53. EYRE, F. H. **Can Jack Pine be regenerated without fire?** *Jnl. For.* 36, 1938 (1067–72).

Successful regeneration of Jack Pine (*P. banksiana* Lam.) may be obtained without burning provided that (1) the forest floor is broken up to expose the mineral soil, (2) a fairly heavy cut is applied, and (3) the slash is scattered and allowed to lie on the ground exposed to the sun for one or more summers.

23.1 (71.1). GODWIN, G. **A regeneration study of representative logged-off lands on Vancouver Island.** *For. Chron.* 14, 1938 (61–83).

Over 90 per cent. of the logged-off lands examined were found to have an unsatisfactory stocking. Reproduction was most successful relatively in areas of unburned slash where a surface burn had occurred prior to logging. Factors influencing regeneration are discussed, and stress is laid on the need for silvicultural and economic research with a view to improving future cutting plans and avoiding the waste of productive land. [G.]

23.12 : 12.25.53. BENINDE. **The conditions for natural regeneration of Pine.** *Zeitschr. F. & J.* 70, 1938 (162–70). [G.]

A preliminary study, extending over 7 years, of the conditions for natural regeneration of

Pine in the Pflastermühl district, West Prussia. The extreme points of the area experience different rainfall, which varies from 580 to 630 mm. Two soil types occur, both sandy but differing widely in particle size, humus content, and degree of leaching. Neither rainfall nor soil type, however, appears to exert a direct influence upon the success of regeneration. Ground vegetation, on the other hand, seems to be an important factor. Successful regeneration occurred on areas of *Hypnum-Calluna* and *Hypnum-Aira*; normal regeneration, but with a period of stunted growth, in *Cladonia-Aira* or pure *Cladonia*; and poor regeneration or none at all in *Vaccinium-Hypnum* and pure *Vaccinium*. With removal of the soil cover no regeneration took place, except on peat, until the areas were recolonized by *Calluna*, *Hypnum*, and *Aira*. Contrary to previous belief, direct sunlight was injurious, in this district at least, and provision for some shade was essential. Protection from wind was also found to be an important factor in success. At present only local validity is claimed for the results of the investigation.

23.13 : 07.3 (67.8). Napier-Bax, S., and Wheeler, G. T. **Some factors governing the efficiency of African labour in bush-clearing work.**—Account of a study by the Dept. of Tsetse Research, Tanganyika Territory. *Trop. Agric.* 15, 1938 (154–61).

Experiments were carried out to discover means of increasing the efficiency of African labour in making anti-tsetse clearings. *Acacia spirocarpa* and *Commiphora fischeri* were used as representative hard- and soft-wooded trees for felling tests. Native and European axe grips were compared, and instruction was given in swinging the axe. It was found that the traditional native grip plus instruction gave better results than the European grip plus instruction. A good type of native axe proved equal in performance to the European ringhead axe, but poorer types were much inferior. Gangs that sharpened their axes during the rest period gained a considerable advantage. At the season of the experiments no advantage was gained by supplying drinking water or by giving the men food during the rest period.

23.13. Aaltonen, V. T. **Soil and the [natural] regeneration of the forest.** *Silva Fenn.* 46, 1938 (25–42 and 238–9). [Fi.g.]

Humus layers may inhibit natural regeneration, and render cultivation necessary. Where the soil is heavily degraded, as in Northern Finland, working to a depth of 20 to 20 cm. is required to secure a satisfactory mixture of the humus with the mineral soil. In Southern Finland shallower working is generally sufficient.

23.2. Artificial formation of stands. Artificial regeneration

23.2 : 12.27.57 (496). Tschermak, L. **The cultivation of *Eucalyptus* on the south coast of Anatolia.** *Zeitschr. f. Weltf.* 6, 1938 (3–18). [G.g.e.]

In 1937, 7,500 hectares were selected on the southern coast of Anatolia for the cultivation of eucalypts, *E. globulus* and *E. rostrata* being particularly recommended. A coppice rotation of 12 years should suffice for the production of mining timber and give a total yield of 120 cu. m. per hectare. Nursery practice, methods of planting, weeding, &c., are discussed.

23.2 : 22.56 : 24.2 (54.2). Sah, D. L. **Notes on canal plantations of the Afforestation Division, Cawnpore.** *United Provinces Forest Department Bulletin* No. 11, 1938. pp. 12.

The paper includes notes on plantation work, statistics of growth, *taungya* operations, and thinnings.

23.2 : 24 : 12.26.82 (54.8). Mitchell, J. E. M. **Note on Sandal regeneration.** *Ind. For.* 64, 1938 (541–51).

After outlining the characteristics and natural habitat of Sandal (*Santalum album* L.), the author gives an account of Sandal-growing in Coorg and recommends two methods of artificial regeneration. Special difficulties are met with in raising and tending stands, since the tree is an obligate parasite and its hosts must receive careful attention in any silvicultural operations. The paper concludes with general notes on tending and an account of certain factors that contribute to the spread of Spike disease.

23.21.6 (931). Perham, A. N. **Pacific Coast species in New Zealand forestry.** *N.Z. Jnl. For.* 4, 1938 (158–61).

At least 95 per cent. of the afforestation in New Zealand has been carried out with the following Pacific Coast species listed in order of importance: *Pinus radiata*, *P. ponderosa*, *Pseudotsuga taxifolia*, *Pinus murrayana*, *Sequoia sempervirens*, *Pinus muricata*, *Cupressus lawsoniana*, *Thuya plicata*, *Cupressus macrocarpa*.

23.23 : 23.24 : 12.26.22 (489). BORNEBUSCH, C. H. **Experiments on the raising of Oak in the forest districts of Vallø Stift.** *Forst. Forsogsv. Dan.* 15, 1938 (139–64). [Da.g.]

The relative merits of different systems of sowing and planting used in the experiments are discussed. The investigations showed, *inter alia*, that it was safer, easier, and cheaper to work with a relatively small number of plants of superior genetic value than to use a large amount of less valuable seed or planting material and rely on selection at the early thinnings.

23.23 : 23.24.1. FABRICIUS, L. **The choice of plants from the seed bed.** *Forstw. Centralbl.* 60, 1938 (297–304). [G.]

Observations on two 18-year-old Pine plantations established to obtain data on the influence of heredity and environment on tree development are described. The two plots were planted in 1925 with 5-year-old plants from heavy and light seedlings respectively. In the autumn of 1937 the average height of the stand derived from heavy stock was 5·85 metres, or 11·7 per cent. higher than that of the stand from light stock, which was 5·22 m. In the autumn of 1927, 1930, and 1935 the differences were 34·2, 17·3, and 12·7 per cent. respectively. It would seem, therefore, that differences due to environment at the seed-bed stage tend gradually to disappear.

23.23.1 : 12.27.72 (91.4). LOPEZ, M. **Storage and germination of Large-leaf Mahogany [*Swietenia macrophylla* King] seeds.** *Philip. Jnl. For.* 1, 1938 (397–408).

Experiments comparing storage methods are described. With proper storage, viability can be lengthened to 132 days.

23.23.1 : 12.25.52 : 12.11.3. RŮZICKA, J. **Evidence of the harmfulness of incorrect seed provenance in Spruce.** *Lesnická Práce* 17, 1938 (533–8). [Cz.g.]

Spruce stands at Utechovice (near Pacov in Southern Bohemia) planted before 1906 at an altitude of 715 m. from seed introduced from the Alps became stunted in their growth and were killed off by *Ascochyta*. This occurred on various soils, the top layer of which was not sealed. Later Spruce plantings with seed from Budweis developed in a satisfactory manner.

23.23.1. ACATAY, A. **Investigations into the quantity and quality of seed found in various parts of the crowns of native forest trees.** *Thar. For. Jahrb.* 89, 1938 (265–364). [G.]

The principal species studied were *Betula verrucosa*, *Acer platanoides*, *Quercus pedunculata* and *sessiliflora*, *Larix europea*, *Tilia grandifolia* and *parvifolia*, *Fagus silvatica*, *Pinus sylvestris*, and *Picea excelsa*. In most of the trees examined the upper part of the crown bore seed in greater quantity than the lower. Weight and germinative energy were generally higher in seed from the upper region of the crown, and, in the case of *Acer platanoides*, the same applied to nitrogen and oil content, while the percentage of ash was lower. Seed from the top of the crown of *Acer*, *Fagus*, *Quercus*, and *Picea* produced considerably stronger plants with longer and more slender shoots, and also, in the case of *Acer*, with larger and thinner leaves and higher mineral content. *Pinus sylvestris* was an exception, producing somewhat poorer seed at the top of the crown than lower down. The study of Larch and Beech led to rather indefinite results except that the best Beech seed was found to be produced on well illuminated shoots and that some individual Beech trees proved far superior in seed-production to the average. In discussing the results of his observations, the author attributes the general tendency to better seed-production at the tops of the crowns primarily to the relatively sunnier and drier environment, as a result of which the seed has a higher content of reserve substances and a lower rate of water saturation, connoting a higher endosmotic pressure (Samensaugkraft). Secondly, he envisages the possibility of less frequent self-pollination in the upper parts of the crowns. No definite explanation is offered for the exceptional behaviour of *Pinus sylvestris*, but it is suggested that the bad water conduction of this species might be responsible.

23.23.13.2 : 12.25.53. TYSZKIEWICZ, S. **Extracting Pine seeds: some experiments on economical kiln-drying.** *Inst. Rech. For. Poland Trav. & Comptes Rendus, Series A*, No. 35, 1938. pp. 95. [Pol.g.]

The experiments were conducted under the ordinary working conditions of an installation of not very large size, such as might be attached to a forest range. The initial properties of the raw material, especially the size and moisture content of the cones; the atmospheric conditions in and outside the kiln during the drying process; and the supervision and organization of the work, were examined mainly in relation

to the quality and output of seed and the length of the process. Different methods of cleaning the seed were also compared. The tables, diagrams, and drawings showing the construction of the drying installation at Lack, where part of the experiments was carried out, are explained in German at the end of the paper.

23.23.15 : 12.27.72. ACUÑA, R. A. **The effect of storage on the germination of West Indian Cedar [*Cedrela mexicana* M. Roem.].** *Philip. Jnl. For.* 1, 1938 (293–9).

The germination of the seed of this species was found to be greatest within 21 days from the date of gathering from the tree. Over 60 per cent. germination was obtained after 91 days of storage in paraffin-sealed bottles. The viability disappeared completely after 147 days.

23.23.15 : 12.25.53. MACKINNEY, A. L., and MCQUILKIN, W. E. **Methods of stratification for Loblolly Pine seeds.** *Jnl. For.* 36, 1938 (1123–7).

A detailed study was made at the Appalachian Forest Experiment Station of the viability and promptness in germination of Loblolly Pine seeds stratified in a number of different media at different moisture content and for various periods of time. It is recommended that in practice the seeds should be stratified before sowing for 2–3 months in thoroughly moistened sand or peat at temperatures between 32° and 40° F.

23.23.19. EIDMANN, F. E. **The practical utility of the Selenium method of seed testing.** *Deutsche Forstwirt* 20, 1938 (445–9: 457–60). [G.]

The Selenium method of seed testing, as devised by the author and officially introduced by the 'Reichsforstamt' in a Decree of September 1937, for the testing of Beech and of Douglas Fir seed, is based on the property of living plant tissue to reduce Selenium solutions; a process associated with a distinct red colouring of the reducing tissue due to the liberation of pure Selenium. The technique of the test is as follows: The seed to be tested, after removal of the outer coat, is soaked for 24 hours at ordinary indoor temperature. Two hours or so after soaking has begun any seed still floating should be 'pushed in' and submerged. Light seed, and particularly seed with a thin somewhat wrinkled inner coat, like that of Douglas Fir, at first tends to float, but after it has been submerged remains under water. The seed is then put into a 2 per cent. solution of sodium biselenite ($NaHSeO_3$). The pH of the solution is 4·5, the optimum for the colour reaction being between pH 4·5 and pH 5·5. The seed remains in the solution for 48 hours at a constant temperature of 30° C., and is then transferred to a 70 per cent. alcohol solution. Extraction of the embryos may follow immediately or can be done at any later time. They remain in the alcoholic solution during the diagnosis, in making which the seed is divided into three categories:

(*a*) Uncoloured embryos or those coloured only to the extent of one-third of their surface may be considered as dead.

(*b*) Embryos showing a red or reddish colour over their entire surface have full viability: according to the author, even those with only a few small uncoloured spots cannot produce healthy plants.

(*c*) Embryos assignable to neither of the preceding groups will mostly be capable of germinating but will not produce normal seedlings under field conditions.

'Germinative potential' (Keimpotenz) as determined by laboratory tests on traditional lines may be attributed to embryos in groups (*b*) and (*c*) together. The author excludes group (*c*) from what he calls 'plant potential' (Pflanzenpotenz), the application of this term being restricted to group (*b*) embryos, which alone have the qualities required to produce healthy plants under optimum field conditions. The intensity of the colour itself, as distinct from the proportion of the surface of the embryo showing colour, is neglected except on the rare occurrence of embryos coloured entirely, but to a shade of red much paler than the rest. Such embryos are very exceptional, and are classified under (*c*) rather than (*b*). The author checked his method with careful field tests made at Eberswalde in 1936–7 with seed of Beech, Douglas Fir, and Scots Pine. The development of every single seed was followed by means of a system of co-ordinates laid down on the ground, using 5 plots of 400 seeds for each species and each method of seed storage. The 'plant potential' as determined by the method very rarely diverged from the plant percentage obtained in the field tests by more than 5 per cent.

The advantages claimed by the author for the Selenium method are: (1) The 'plant potential' is a direct indication of the *practical* value of seed under field conditions. (2) The method is

quick and involves relatively little work. Dr. Eidmann's trained staff deals with a 3 × 100 lot of Douglas Fir in three man hours—one man hour for peeling, one for the extraction of the embryos, and one for diagnosis and miscellaneous operations. (3) The method is unaffected by seed dormancy.

23.23.19. VIADO, J. **The cutting test as a practical method of testing viability of seeds.** *Philip. Jnl. For.* 1, 1938 (219–25).

The cutting test is considered a fairly reliable method for all practical purposes, as far as afforestation work in the Philippines is concerned. Collection of further data is desirable to arrive at the real value of the method for each species.

23.23.19 : 12.11.21 : 12.25.53. STROHMEYER. **On the importance of the weight of seed in raising Pine.** *Forstarchiv* 14, 1938 (154–7). [G.]

A correlation was found to exist between the weight per 1,000 seeds of the parent tree and the number of needles per seedling in the 1-year-old progeny, needle number being expressed as the average of 100 counts. Increase in the weight per 1,000 seeds corresponded to increase in the number of needles per seedling. The same result was obtained when counts were made with seedlings of two weight groups sorted out from the seed of one and the same parent. The weight per 1,000 seeds of individual trees may show considerable annual variations, but generally weight varies little from year to year. There is some evidence that the general vigour of seedlings increases with weight of seed, at least in the initial stages of development. No correlation was established between site quality and weight of seed. Old trees usually, but not invariably, produce lighter seed than young ones. Relations also exist between the weight per 1,000 seeds, the cone and seed production, and the number of seeds per cone of individual trees. These and other points are to be dealt with in a later paper.

23.23.19 : 23.23.3. CAGUIOA, V. **Germination and early development of White Lauan (*Pentacme contorta* (Vid.) Merr. & Rolfe) under various media.** *Philip. Jnl. For.* 1, 1938 (65–77).

In these experiments White Lauan germinated very rapidly, the maximum time required being 16 days. Rate of germination and mortality of seedlings were affected by the type of surface soil. Clay loam was found to be the best soil; for although it gave a lower percentage of germination than some other soils, the seedlings were healthier and mortality was low. The other media tried, in descending order of suitability, were sawdust-clayloam, sand, charcoal-clayloam, ash-clayloam, sawdust, and charcoal.

23.23.19 : 23.23.15 : 12.27.48. DELIZO, T. **Methods of hastening the germination of the seeds of Akle (*Albizzia acle* (Blanco) Merr.).** *Philip. Jnl. For.* 1, 1938 (99–102).

Untreated Akle seed normally takes 120 days to germinate. Mechanical wounding of the seeds hastened germination, but many of the seeds so treated were lost by fungus attack. The best method of inducing rapid germination was found to be immersion in commercial sulphuric acid for 1 hour. This treatment partly dissolves the cutin in the seed coat, thus facilitating the absorption of water by the seed.

23.23.19 : 12.11.3 : 12.25.52 (43.14). RUBNER. **Germination of seed from the Green- and Red-coned Spruce.** *Thar. For. Jahrb.* 89, 1938 (247–51). [G.]

Two series of germination tests were carried out at Tharandt on seed from green- and red-coned Spruce. The seed employed was collected from 9 pairs of seed trees in the Seitenberg district; each pair of trees stood as close together as possible, and there was reason to believe that all belonged to races indigenous in the district. Both series of tests showed an appreciable difference in rapidity of germination between the two races, germination of the seed from green cones having a lag of 1–4 days. In general, red-coned Spruce showed a higher proportion of viable seeds. After 20 days there was no significant difference in the percentage germination of viable seeds. The results of the experiment are summarized in a table. It is suggested that, other things being equal, seed from red-coned Spruce should be given preference.

23.23.19 : 11.15 : 12.25.52. ROHMEDER, E. **The influence of phases of the moon on the germination and earliest stages of development of Spruce.** *Forstw. Centralbl.* 60, 1938 (593–603, 634–46). [G.g.]

In numerous germination and seed-bed observations no influence of the moon on the germination and earliest phases of development of Spruce could be discovered. Any influence

that might exist must be so insignificant as to be of no practical importance.

23.23.3 : 12.11.21 : 12.27.49 (73). MEGINNIS, H. G. **Effect of depth of sowing on nursery yields of Black Locust.** *Jnl. For.* 36, 1938 (411–16).

Large numbers of *Robinia pseudacacia* seedlings are required in America for soil conservation work, but the yield of seedlings from nursery sowings has been extremely low. Depth of sowing has long been suspected as an important factor affecting the percentage of seedlings obtained. The author's experiments confirm this and seem to justify the recommendation that seeds should be sown $\frac{1}{4}$–$\frac{1}{2}$ in. deep. Although the scope of the experiments was limited, consistent results were obtained in two different seasons in two nurseries with widely different growing conditions and soils.

23.24 : 12.28.47 (54). GRIFFITH, A. L. **An investigation into the relative merits of planting Teak (*Tectona grandis*) stumps in pits and in crowbar holes in areas having a West Coast type of climate.** *Ind. For. Rec.* 3, 1938 (47–59).

The investigation consisted of 11 experiments conducted at 5 centres over a period of 3 years (1932 to 1934). Consideration of the survival percentage and mean height growth at the conclusion of the first growing season after planting shows that planting in pits gives results not appreciably different from planting in crowbar holes. Pitting, being much the more expensive method of preparing the soil for planting, is not therefore economically justified. (A 'stump' is a root-and-shoot cutting made from a 1-year-old nursery seedling.)

The localities in which the experiments were carried out have a climate typical of the West Coast in general and an average annual rainfall varying from 60 to 120 in., and are at varying elevations from the plains up to 3,000 ft. The soils in all cases are light forest soils with naturally good aeration. *From Author's abstract.*

23.24 : 12.28.47 (54). GRIFFITH, A. L. **An investigation into the best root length of stump to use when stump planting Teak (*Tectona grandis*) in areas having a West Coast type of climate.** *Ind. For. Rec.* 3, 1938 (1–15).

The investigation consisted of 11 experiments conducted at 4 centres over a period of 4 years (1932 to 1935). From a consideration of the survival percentage and mean height growth at the end of the first growing season after planting, it is concluded that there are no appreciable differences in results from stumps with roots ranging in length from 6 to 10 in. but that a root length of 4 in. gives definitely poorer results. (A 'stump' is a root-and-shoot cutting made from a 1-year-old nursery seedling). The investigation also shows that stumps of 0·7 to 0·8 in. diameter give appreciably better results than those of 0·3 to 0·4 in. diameter. The localities in which the experiments were carried out have a climate typical of the West Coast in general and an average annual rainfall varying from 60 to 120 in., and are at varying elevations from the plains up to 3,000 ft. The soils in all cases are light forest soils with naturally good aeration. *From Author's abstract.*

23.24 : 12.25.54 (74.7). LITTLEFIELD, E. W., and ELIASON, E. J. **Observations on a plantation of Dunkeld hybrid Larch in New York.** *Jnl. For.* 36, 1938 (1188–92).

This plantation was established in 1932 with 2+1 stock raised from seed from the Japanese Larch growing at Dunkeld, Scotland. Of the three genetic types recognized, the *Kaempferi* (Japanese) type grew significantly more slowly than either the 'intermediate' or the '*decidua*' (European) type. Selection is advisable, and can be practised in the nursery, since these types can be recognized as 2-year seedlings.

23.24.1. LAUGHTON, F. S. **The raising of transplants of indigenous tree species for open-rooted planting.** *Jnl. S.A. For. Assn.* 1, 1938 (17–27).

A technique that has proved successful for raising transplants of indigenous species for open-rooted planting at Deepwalls is outlined. The following species are dealt with: *Podocarpus latifolius*, *P. falcatus*, *P. Henkelii*, *Ocotea bullata*, *Olea laurifolia*, *Curtisia faginea*, *Gonioma kamassi*, *Cunonia capensis*, *Faurea macnaughtonii*, *Rapanea melanophleos*, and *Ekebergia capensis*. Brief notes on the time of seeding, the collection and treatment of seed, and the choice and preparation of nursery beds are also included.

The importance of producing superficially rooted plants, in order to facilitate transplanting, is stressed, and the use of shallow beds over clayey subsoils, repeated transplanting, and bending up of the roots at the time of transplanting are suggested as effective measures for attaining this object. *Author's Summary.*

23.24.11 (91.4). LANTION, D. C. **Wild forest seedlings as planting stock.** *Philip. Jnl. For.* 1, 1938 (199–210).

According to the results of an investigation conducted near the town of Pañgil Laguna, the use of planting stock of forest-pulled seedlings of Apitong (*Dipterocarpus grandiflorus* Blanco) and Tiaong (*Shorea teysmannia* Dyer) did not appear profitable. The percentage of survival was found to be influenced by the size of the seedlings when pulled. Seedlings that were puddled gave a higher percentage of survival than those that were not.

23.24.14 : 12.26.91. VIADO, J. **Survival of Bagilumbang [*Aleurites trisperma* Blanco] seedlings under varying lengths of storage.** *Philip. Jnl. For.* 1, 1938 (275–82).

The methods of treatment, packing, and storage adopted gave a fair percentage of survival after a storage period of about 18 days. The seedlings were natural ones and had been lifted with bare roots.

23.24.4 : 12.28.47 (54.8). GRIFFITH, A. L. **An investigation into the best date of stump-planting Teak [*Tectona grandis*] at Begur [Wynaad Division], Dhoni [Palghat Division], and Topslip [South Coimbatore Division].** *Indian Forest Records* [*New Series*], *Silviculture* 3, 2. 1938. pp. 46.

Stump-planting of Teak at Begur and Dhoni (Madras) in the middle of April, 6–7 weeks before the break of the monsoon, gave results far superior to those of normal planting in early June. At Topslip, where pre-monsoon rains are more variable than at Begur and Dhoni, planting had to be delayed until the early part of May to minimize the risk of poor stocking.

23.25 : 12.27.62 (54.3). HUSSAIN, M. T. **Regeneration of Semal (*Bombax malabaricum*) from root suckers.** *Ind. For.* 64, 1938 (398–400).

Experiments in the South Chanda division, Central Provinces, showed that *Bombax malabaricum* can be regenerated from root suckers. Suckering was induced by cutting or bruising the large lateral roots of standing trees or fresh stumps; similar treatment of thin roots farther away from the parent stock did not give good results. Fencing against browsing by Chital seemed to be essential. The results are of a preliminary nature, but there are good prospects of developing a suitable technique.

23.25.1 : 12.11.22.4 : 12.26.41. BAAK, W. **The propagation of Poplars by cuttings.** *Forstarchiv* 14, 1938 (101–6). [G.g.]

A concise summary of the author's long experience in raising nursery stock of Poplars from cuttings. The relative merits are discussed of end-cuttings and cuttings with lateral buds only. When fully lignified and planted with the terminal bud underground, end-cuttings give satisfactory results; but, if rightly treated, cuttings of the second type are preferable on account of their far stronger root system. Cuttings should be taken in mild weather from December to February, divided at once into lengths, and bundled in lots of 100. Short cuttings 15–18 cm. long and 5–10 mm. thick are the best. To reduce the wounded area, cuts should be horizontal and not oblique, and the upper end should be trimmed as close as possible to the topmost lateral bud. The bundles should be stored in moist, humus-free sand and stagnation avoided. Planting may be done from March to April at intervals of 18–20 cm. in rows 35–40 cm. apart. The top of the cutting should always be beneath the soil, to secure rapid occlusion and straightness of stem. Care should be taken to avoid damage in all operations. All the recommendations are designed to secure rapid healing and the development of a good root system and a straight stem. Under such conditions losses are almost nil.

23.25.1 : 12.26.41. HOFFMANN, R. **Investigations into the growth of Poplar cuttings.** *Forstw. Centralbl.* 60, 1938 (361–73, 410–24). [G.]

According to observations in Hagenbach, the growth of Poplar cuttings is influenced in a decisive manner by 'branch induction'. Cuttings taken from the main stem and from side branches of the first order produce straighter and faster growing plants than those from branches of a higher order; the degree of curvature and of poor or arrested growth varying more or less directly with the order of origin of the branches. Cuttings from leading shoots (Leittriebe) and side-leaders (Nebenleittriebe) behaved similarly to those from main stems and from side-branches of the first order. It was not possible to counteract the effect of 'induction' by tying the cuttings to a pole in a vertical position. The degree of 'induction' varied with the different races of Poplar examined, and in Canadian Poplar seemed to be very stable. Cuttings from the tops of the shoots (Kopfsteckhölzer) showed inferior development to those

from the bottom (Fussteckhölzer), producing slower growing and more crooked plants.

23.26 : 23.24.2 : 23.23.15 (91). Walton, A. B. **Some notes on nursery and planting technique.** *Mal. For.* 7, 1938 (122–6).

An account is given of several experiments carried out in the Kepong nursery. Two of these demonstrated the beneficial effect of 'wrenching' [i.e. severing the tap-root 2–3 in. below ground-level to promote a bushy root development] on seedlings of *Dryobalanops oblongifolia*: 'wrenched' seedlings were markedly superior to ordinary seedlings and transplants. Other experiments on deep planting of the same species were not particularly conclusive, but shallow planting was shown to be undesirable. Finally, the author describes the system of hastening germination of leguminous seeds by pre-treatment with hot water. Suitably treated seeds can be sown direct in the field without incurring nursery expenses. Successful results have been obtained, but the technique of treatment needs to be worked out in further detail.

23.26. Ahola, V. K. **Raising young trees.** *Silva Fenn.* 46, 1938 (224–36 and 244). [Fi.g.]

Questions of nursery practice and the results of experiments in certain small forest nurseries on moorland soils are discussed. These nurseries, laid out inside the forest, did not require regular irrigation, and the production of plants in them was relatively inexpensive.

23.26 : 98.1 (43). Klé. **German forest policy and forest nurseries.** *Bull. S. Fr.-Comté* 22, 1938 (419–23).

Germany has 180–200 forest nurseries proper, 1,000–1,200 plant culture establishments, and 70–80 seed-culture establishments; the owners of all these are represented on the 'Reichsverband der Forstpflanzenzüchter und Klenganstalten' which, in collaboration with the Government, controls the output of, and commerce in, forest nursery produce; its functions including the fixing of prices. The main objective in the production of nursery stock is qualitative, the aim being to increase the timber : firewood ratio in German forest production. (The paper is an extract from the *Revue Internationale du Bois*.)

23.3. Afforestation

23.3 (42). Guillebaud, W. H. **The afforestation of difficult peat and upland-heath soils.**—Extract from Annual Report on the research work of the Forestry Commission of Great Britain for 1937. *Forestry* 12, 1938 (80–92).

The extract deals with the preparation of the ground and planting methods on peat and Upland-Calluna soils respectively, and with the use of Pine-Spruce mixtures on the latter. The results of plantation experiments during the past fifteen years are summarized, and the conditions prevailing in the several forests mentioned are outlined in brief notes.

23.3 (64). Putod, R. Travaux du reboisement de Meurdja: Monographie. **[Monograph on afforestation works at Meurdja.**—Eroded slopes of the Atlas Mts.**]** Unpublished *Mss.* 1938. pp. 27.

The manuscript gives technical and financial details of afforestation work with different species, and also a list of exotics grown in the arboretum with notes on their success or failure, &c.

Conifers (*P. halepensis*, *P. pinea*, *Cedrus atlantica*, *Cupressus sempervirens*) planted with naked root ('à racine nue') showed over 95 per cent. of success, and the author claims this method to be the most economical one in regions with over 800 mm. annual rainfall. Irrigation of the plantations during the hot and dry season was replaced by dry-farming methods.

23.3 : 12.25.53 (43). Růžička, J. **The Murray Pine [*Pinus murrayana* Balfour].**—Possible use in afforestation. *Lesnická Práce* 17, 1938 (646–50). [Cz.g.]

The Murray Pine was introduced to Germany from the North American Highlands some 40 years ago and has since been grown successfully on the poorest sites, including heather and moorland soils. The plantations in Bohemia date from 1932, but there the Murray Pine did less well on poor soils than *P. strobus*.

23.3 : 23.24–26 (67.5). Roels, A. **Reforestation in the Bas-Congo.** *Bull. agric. Congo Belge* 24, 1938 (745–53). [Flem.]

After referring to the urgent need for reforestation in the Bas-Congo, the author pleads for the establishment of a proper silvicultural service with reforestation as its sole concern. Such a service should consist of white supervisory officers aided by a staff of trained Africans. Nurseries should be laid out in selected places and due consideration given to the requirements of individual species. As a first step in this direction a list is given of the scientific and vernacular names of recommended

trees, arranged according to their soil requirements. In a second list the species are grouped according to suitable methods of propagation (setts, root cuttings and suckers, cuttings, and seed). The article concludes with some notes on nursery and planting-out practice.

24. *Education of Stands. Tending. Thinning*

24.21 (47.1). HEIKINHEIMO, O. **Thinnings.** *Silva Fenn.* 46, 1938 (87–98 and 240). [Fi.g.]

A correct thinning practice for the different forest types in Finland can be evolved only as a result of experiments with permanent sample plots such as are conducted by the Forest Research Institute of Finland. Results from similar research abroad, especially in Germany and Sweden, are not applicable.

24.23 : 12.28.47 (54). LAURIE, M. V. **A rough guide to thinning Teak based on average spacing for a given mean diameter.** *Ind. For.* 64, 1938 (397–8).

The author suggests that the minimum espacement for irregular forests of Teak might be found by adding 3 to the diameter of the tree in inches and thinning to the same number of feet around it. This recommendation is based on theoretical considerations and should first be tested out on a small scale to see if it gives good results under local conditions.

24.25 : 56.2 : 56.4 : 12.25.52 (43). ZIMMERLE, H. **Investigations on the increment of Spruce in the Härtsfeldhausen district.** *Allg. F. & J.* 114, 1938 (341–51). [G.]

The 'external' trees (trees from the external zone of the internal strip or 'Innensaum'), which had been gradually freed through thinnings in the course of 20 years under the Wagner *Blendersaumschlag* system, had put on more increment than comparable stems inside the forest, and had, moreover, put on true light increment higher up the stems, with a resultant improvement of their stem form.

24.5 : 12.25.52 (74). CURTIS, J. D. **Preliminary results of pruning Norway Spruce in plantations.** *For. Chron.* 14, 1938 (119–31).

Describes experimental work in Connecticut and Massachusetts. So far it seems that on most sites healthy trees can be advantageously pruned for the first time before a plantation is more than 20 years old, and that no serious defects may be expected to follow the operation if it is done correctly and carefully.

24.5 : 12.25.53 (942). JACOBS, M. R. **Notes on pruning *Pinus radiata*: Pt. I.—Observations on features which influence pruning.** *Austral. Cw. For. Bull.* No. 23. 1938. pp. 47.

This bulletin gives the results of observations on features which influence the problem of pruning in plantations of *P. radiata* in southern Australia. The first section deals with features of the individual tree which influence pruning. It is shown that most undesirable whorl forms are caused in the adolescent state of the Pine, when the primary needles become photosynthetically active at certain times of the year only and cause irregularities in the basal whorl of the annual shoot. Regressions showing the relationship between branch basal area and stem basal area are also worked out. The second section deals with the effect of espacement on tree-forms. The fourth section deals with the effect of pruning on the growth and quality of the crop. Several experiments on green-pruning are described. It has been shown that severe green-pruning depresses height and diameter increment, increases the size and acuteness of branches above the pruned zone, and stimulates the development of epicormic shoots. Observations on the occlusion of pruning scars are discussed and it is shown that diameter increment is the most important factor controlling occlusion. It is also shown that the early training of the Pine is by no means an economic impossibility in the wider espacements. The fifth section gives some thoughts on pruning policy which arise from the results of the experiments. *Author's summary.*

3. UTILIZATION. TECHNOLOGY

31. *Properties of Wood*

31.15 (8). KYNOCH, W., and NORTON, N. A. **Mechanical properties of certain tropical woods, chiefly from S. America.** *University of Michigan, School of Forestry and Conservation, Bulletin* No. 7. 1938. pp. 87.

Data from about 30,000 observations on 38 species are given in tabular form. A detailed

study was made of the structure and mechanical properties of Cativo (*Prioria copaifera* Gris.), Carbonero (*Piptadenia pittieri* Harms), Balsamo (*Toluifera balsamum* L.), Bosuga (*Fagara monophylla* Lam.), and Trompillo (*Guarea trichilioides* L.). Some woods are suggested as worthy of further investigation.

31.2 : 31.13. Prat, S. Durchlässigkeit des Holzes für infrarote und für X-Strahlen **[The permeability of wood to infra-red and X-rays].** *Repr.* from *Berichten der Deutschen Botanischen Gesellschaft* 55, 1937 (165–71).

The permeability of wood to infra-red rays was found to depend on molecular, and to X-rays on atomic, characteristics. Different woods showed different degrees of permeability to infra-red rays, but all the woods examined behaved similarly when exposed to X-rays, equal thicknesses of different species being more or less equally permeable. With suitable thicknesses it was possible to take photographs giving some indication of structural features such as growth-ring boundaries, rays, &c.

31.2 : 32.33 (47.42). Koresaar, J. **Investigations into the mechanical properties of mining-timber from the Pine forests of Alutaguse.** *Mitt. Forstw. Abt. Tartu Estonia* No. 30. 1938: pp. 161. [Est.g.]

The suitability for mining purposes of timber obtained from the Scots Pine forests of Alutaguse was examined in a series of tests and observations. The stands were classified according to Rühl's forest types, due attention being paid to quality classes and to the degree of suppression. The material to be tested was further sub-divided according to the parts of the trees from which it was obtained. The anatomy of the wood as affecting its physical properties, its specific gravity, resistance to compression, bending-strengths in the earlier and the later stages of the test, bearing-strength, coefficient of elasticity, shrinkage, the effect of blue stain, and the warning given before breakage by cracking and splitting were studied, and the results shown in numerous tables and diagrams. The comparison of the final results with those obtained from similar tests in other countries showed that the technical qualities of the Alutaguse Pine were from satisfactory to good, and that it was entirely suitable to meet the growing demands of the Esthonian mining industry.

31.2. Clarke, S. H. **The properties of timber as influenced by growth in tropical climates.** *Emp. For. Jnl.* 17, 1938 (247–8).

Weight for weight, tropical timbers are usually stronger in compression parallel to the grain, though not so tough as timbers of the temperate zone. This is ascribed to stronger lignification of the cell walls under the influence of tropical climate.

31.22. Barkas, W. W. **Recent work on the moisture in wood in relation to strength and shrinkage.** *D.S.I.R., Forest Products Research Special Report* No. 4. 1938. pp. 35.

The most important contributions of the Physics Section of the Forest Products Research Laboratory are the differentiation between the molecular and capillary water held in the cell wall; the demonstration that the water in the cell cavities cannot be sharply differentiated from the capillary water in the cell walls; the proof that strength, shrinkage, and vapour pressure changes begin in wood as soon as it is dried below the water-logged moisture content; and the evidence put forward that wood reacts identically under externally applied loads and under internal shrinkage forces.

31.22. Erickson, H. D., Schmitz, H., and Gortner, R. A. **Directional permeability of seasoned woods to water and some factors which affect it.** *Repr.* from the *Journal of Agricultural Research* 56, 10, 1938 (711–46).

Radial flow in sapwood was very much less than tangential in resinous woods, but in non-resinous woods the difference was insignificant and the radial flow less. Sapwood was nearly always more permeable radially than heartwood. Springwood and summerwood were about equally permeable radially at high pressures in sapwood, but springwood was usually the more permeable in heartwood. Using corrected values, longitudinal permeability was thousands of times greater than lateral permeability. The rate of flow usually decreased with increasing time of continuous flow. The ratios of the permeabilities in three planes are given for a number of woods.

31.22.2 : 12.27.39. Suarez, V. **Shrinkage allowance in sawing one-inch Yakal (*Hopea plagata* (Blanco) Vid.).** *Philip. Jnl. For.* 1, 1938 (31–7).

From an analysis of the shrinkage of 57 Yakal boards the author has compiled tables of shrinkage allowances for plain and quarter-sawn timber.

31.22.2. STEVENS, W. C. **The shrinkage and expansion of wood.** *Forestry* 12, 1938 (38–43).

The results of a series of tests at the Forest Products Research Laboratory, Princes Risborough, indicated: (1) that shrinkage starts at a comparatively high moisture content, probably as a result of the forces induced by the extraction of moisture from the cell cavities; (2) that the shrinkage-moisture content relationship is not linear until a moisture content of about 20 per cent. has been reached, and even then it is only approximately so, and (3) that a definite hysteresis loop occurs for drying and wetting above a moisture content of about 20 per cent. *Author's summary.*

31.24. RIERINK, A. **On the calorific values of sixty Netherland-Indian timber species.** *Reprint* from *Tectona* 31, 6, 1938 (400–18). [Du.e.]

Most of the species examined showed very little difference in calorific value. The only exceptions were species in which the heartwood contained substances of high calorific value. In most cases the heartwood had a calorific value only slightly higher than the sapwood. Average figures for the highest and lowest calorific value of oven-dry wood are 4,800 and 4,460 calories respectively. High calorific value may indicate high fuel value, but since the latter value is affected by many factors, the indication is not necessarily reliable. A list of species with their calorific values and specific gravities accompanies the article.

31.27 : 12.25.52. VORREITER, L. **Bending-strength and resistance to compression of frozen Spruce timber.** *Thar. For. Jahrb.* 89, 1938 (491–510). [G.g.]

Frozen Spruce timber showed a bending-strength roughly 100 per cent. and resistance to compression 50 per cent. higher than unfrozen timber under the same conditions. The flexibility of the frozen wood was reduced by two-thirds. Its bending-strength increased considerably with rising water content. The physical tests carried out, and a few observations in the field, suggested that frozen Spruce trees of a close stand which were prevented from bending beyond the limit of flexibility were capable of supporting a load of snow and ice twice as heavy as unfrozen trees under equal conditions. On the other hand, it was concluded that frozen trees were more likely to break wherever lateral protection was lacking.

31.27. GHELMEZIU, N. **Researches on the impact strength of structural timbers.** *Holz* 1, 1938 (585–601). [G.g.]

The object was to determine the conditions necessary for obtaining comparable results in tests of impact strength. Hammers of 10 and 15 mkg. weight were employed, but no significant difference was observed. On the other hand the size of test pieces and the care exercised in cutting and preparing them had a marked effect on the results. Increase of moisture up to 15 per cent. lowered the resistance of Pine, Spruce, and Beech, but increased the resistance of Oak: above 15 per cent. moisture no clear relation could be demonstrated. In sound wood a relation exists between impact strength, other physical properties, and anatomical structure, although impact strength cannot be predicted directly from such properties. The relation does not hold good for unsound timber.

31.27 : 12.25.53 (942). LANGLANDS, I. **The mechanical properties of South Australian plantation-grown *Pinus radiata* D. Don.** Commonwealth of Australia C.S.I.R. *Pamphlet* No. 87 [Division of Forest Products, *Technical Paper* No. 30]. 1938. pp. 53.

Tests on clear specimens from 24 trees grown in 4 different plantations showed that the mechanical properties of *Pinus radiata* compare very favourably with those of other conifers. The properties varied considerably with position in the tree, sapwood from the butt being usually the strongest portion. With the exception of cleavage strength, static strength properties were unaffected by the direction of loading, but impact strength was greater when the load was applied to the tangential surface. Density and mechanical properties were found to be interrelated, but the correlation was not sufficiently exact to allow of accurate prediction in this respect. Safe working stresses and the influence of rate of growth upon strength properties are also discussed.

31.3. WACEK, A. VON. **The present position of the chemistry of lignin.** *Holz* 1, 1938 (543–8). [G.]

The different methods of extracting lignin from woody plant tissues are mentioned and the established facts regarding the chemical structure of lignin are summarized with special reference to recent results. These facts partly explain the behaviour of lignin in extraction processes and also permit of some predictions

as to future technical uses of lignin. The paper contains a very detailed bibliography.

31.42.1. FINDLAY, W. P. K. **The natural resistance to decay of some Empire timbers.** *Emp. For. Jnl.* 17, 1938 (249–59).

(1) A description is given of a laboratory method of testing the resistance to decay of timbers—small selected samples are exposed to fungal attack under controlled conditions for 4 or 8 months, and the amount of attack estimated from the percentage loss in dry weight caused by the test fungi. (2) The results obtained with a number of species of Empire and home-grown timbers are tabulated and the timbers are classified on a basis of their resistance to decay. (3) The nature of decay resistance and the importance of the soluble extractives in increasing the resistance of a timber to fungal decay are discussed. *Author's summary.*

31.42.1 (73 : 91.4). REYES, L. J., and AGUILAR, L. **Relative resistance to decay of American and Philippine woods under Philippine conditions.** *Philip. Jnl. For.* 1, 1938 (301–26).

Of the woods used or potentially suitable for automobile bodies, untreated native woods in many instances outlasted American woods; the preservative metal coatings of the latter proving on the whole ineffective. The inherent beauty of grain of many of the native woods, combined with their durability, might justify their use in automobiles intended for the tropics.

31.43.2 : 45. BROWNE, F. G. **The incidence of Ambrosia Beetle attack on poisoned and girdled trees.** *Mal. For.* 7, 1938 (77–86).

The incidence of Ambrosia Beetle attack on girdled trees and trees poisoned with sodium arsenite is described. The girdled trees showed slight but steady attack, almost entirely confined to the region of the girdle, with a tendency for infestation to increase as the trees died. The poisoned trees showed very heavy attack on the whole length of the stem for several weeks, followed by a steady decline, the fluctuation being most marked when a strong solution of poison was used. The causes of the variations observed are obscure, but it is considered that fluctuations in moisture content may be an important factor. The phenomenon is discussed with reference to its practical applications. *Author's summary.*

31.43.2 : 12.11.6. PHILLIPS, E. W. J. **The depletion of starch from timber in relation to attack by *Lyctus* beetles: I. Starch, with special reference to its occurrence in timber.** *Forestry* 12, 1938 (15–29).

This paper forms an introduction to a series dealing with practical methods of depleting timber of its starch content with a view to rendering it immune to attack by *Lyctus* Powder-post beetles. The available information on starch is summarized and considered with special reference to this problem. Variations in the structure, composition, and physical properties of starch are noted. Several chemical methods of starch determination are mentioned and a visual method for estimating the amount and distribution of starch in timber is described. The storage system of trees and the physiology of reserve food materials (especially starch) are described and discussed. Finally, the principles of starch depletion and the difficulties involved in various practical methods are considered. *Author's summary.*

31.43.2 : 12.11.6. PARKIN, E. A. **The depletion of starch from timber in relation to attack by *Lyctus* beetles: II. A preliminary experiment upon the effect of girdling standing Oak trees.** *Forestry* 12, 1938 (30–7).

Four Oaks (*Quercus robur* L.) were girdled at the top of the main trunk through bark, phloem, and cambium in July 1935: 2 of the trees were also girdled near the base. One pair was felled after 5 months, the other after 17 months. In all 4 trees the sapwood below the upper girdle was rendered devoid of starch and the presence of a lower girdle did not seem to accelerate the depletion. Stain and decay fungi entered the sapwood at the girdles, the deterioration being negligible after 5 months but rather marked after 17 months. The starch-free sapwood was shown to be unsuitable for the development of larvae of *Lyctus* Powder-post beetles. *Author's summary.*

31.43.2 : 12.11.6. PARKIN, E. A. **The depletion of starch from timber in relation to attack by *Lyctus* beetles: III. A second experiment upon the girdling of standing Oak trees.** *Forestry* 12, 1938 (117–24).

Twenty standing Oaks (*Quercus robur* L.) were girdled in May 1937 through bark, phloem, and cambium about 20 ft. above ground, and were felled in January 1938. The treatment cost 0·73 pence per cubic foot of timber below the girdle, and this amount could without doubt be considerably reduced. Development of the current annual ring of wood was arrested, and the leaves fell a month earlier than normal.

Depletion of starch from the sapwood, below the girdle, of all treated trees was recorded, but considerable variation occurred both between trees and in different parts of the same tree. Depletion commenced as soon as the trees were treated and probably finished about the end of September. A further reduction of starch content in December was recorded but the reason for this fall is obscure; it does indicate, however, that the starch-containing cells were still alive and functioning up to the time of felling. At the time of felling, 3 trees still contained sufficient starch to be adjudged definitely liable to *Lyctus* Powder-post beetle attack, 9 were classed as non-susceptible, and 8 as partially susceptible. *Author's summary.*

31.8. Frey-Wyssling, A. **On the origin of resin pockets.** *Holz* 1, 1938 (329–32). [G.]

Evidence is put forward in support of the view that the resin pockets of Larch and Spruce originate as wind shakes in the cambial region of the stem, the cavities thus formed becoming filled with resin from the ruptured radial ducts. Similar shakes (not attributable to seasoning) occur in *Juniperus virginiana*, but in that species no resin enters the cavities and no wound tissue is produced. It is suggested that the formation of wound tissue in Larch and Spruce may be excited by the resin itself, and some confirmation of this is afforded by experiments with potato tubers. Pockets were cut in the tubers and resin was injected into some of the cavities: wound tissue formed in the resin-filled cavities, while the tissues of empty cavities remained unaltered. Resin pockets are not to be confused with cankerous resin-galls, which arise in other ways.

31.8. Dadswell, H. E., and Langlands, I. **Brittle heart and its relation to compression failures.** *Emp. For. Jnl.* 17, 1938 (58–65).

Brittle heart has been observed in many Australian trees, and particularly in eucalypts. Macerated material always contains broken fibres, which do not occur in material from true wood. Broken fibres have their origin in minute compression failures in the wood. Gross compression failures, however, have been shown to occur outside the brittle heart, and it has been suggested that gross and minute failures are due to different causes. The authors stress the need for more information on both types of failure.

31.8 : 12.27.57. Jacobs, M. R. **The fibre tension of woody stems, with special reference to the genus *Eucalyptus*.** *Commonwealth Forestry Bureau Publication* No. 22. 1938. pp. 37.

The bulletin describes a phenomenon that is apparently general in woody plants. Successive layers of growth differ in slight tension, and are held stretched by the inside core. As a result of this a cumulative radial tension is built up which imposes an equal compression on the heart. In trees the compression of the heart becomes very severe and finally the heart is compressed beyond its limit of elasticity, the mechanical properties of the heart wood being seriously affected.

This phenomenon has been called 'fibre tension', and has been found to be the causative or an assisting influence behind brittle heart, compression failures, heart shakes in green timber, and other features of eucalypt timber. Quantitative methods of measuring fibre tension, and the principles underlying them, are described. The only exception to the general radially increasing tension found in a wide range of species was in the compression wood of Pines, which was found to be in compression in a green state. *Author's summary.*

32. *Harvesting of Wood. Logging*

32.32.1 (54). **India.** *Report* and Appendices of the Sleeper Pool Committee, 1936–7. Govt. of India Press, Calcutta. 1938. pp. 51.

Future sleeper requirements are discussed, and the life, true annual cost, and advantages of wooden sleepers. Expenditure on wooden sleepers for 1930–7 and the relative positions of various types of sleeper in the years 1932–7 are reviewed. A table shows the costs and outturn of the Dhilwan Sleeper-Treating Plant. Appendices give figures for sleepers purchased and laid during the year, the total number and mileage of sleepers in Class I railways, reports on prices, and information on the composition and activities of the various Sleeper Groups. The report is accompanied by a map showing the areas administered by the Groups.

33. *Conversion. Preservation. Fashioning of Wood*

33 (54). Kamesam, S. **Latest developments in the utilization of timber in India and abroad.** *Ind. For.* 64, 1938 (335–44).

Timber connectors, laminated structures, waterproof plywood, insulation boards, pre-

fabricated houses, and the use of wood as a source of power, are discussed as the most important features of modern timber utilization. A promising field has been opened up in India for coniferous poles for electrical transmission: extraction and transport of poles of the required length was formerly a great difficulty, but the recent invention of a cheap and efficient pole joint has made it possible to extract poles in lengths of not more than 20 ft., and this is expected to encourage the use of thinnings from Himalayan forests. The author also gives a brief review of developments in portable parquet flooring, branchwood road blocks, artificial hardening of wood, fencing materials, wooden piles, and the chemical utilization of wood.

33.11. THIELE, E. **Modern woodworking machines.** *Holz* 1, 1938 (345–53). [G.g.]

Recent progress in the construction and use of woodworking machinery is discussed in some detail. With the aid of 19 photographs and diagrams improvements are explained in saws of different types, in planing, edging, turning, drilling, tenoning, and polishing machines, in machines for the manufacture of plywood, in special machines and tools of various descriptions, and in materials employed in the building of machinery. Further improvement in these materials is expected in the near future.

33.21. STEVENS, W. C. **Machinery and equipment used for bending wood.** *D.S.I.R., Forest Products Research Records* No. 25. 1938. pp. 13.

Various methods and equipment are described for bending wood and plywood by means of power-driven machinery. Equipment for setting the bends is also dealt with.

33.24 : 23.3 (44.4). FRANÇOIS, T. **Note on the production of paper pulp in the coniferous forests of the Savoyan Alps.** *Rev. E. & F.* 76, 1938 (493–504). [F.]

It is suggested that timber merchants should themselves select the trees suitable for pulpwood (10–35 cm. diameter) from those marked by the Service for selection fellings. The aim is to increase the production of pulpwood by reducing the exploitable diameter from 60 to 50 cm. wherever this is possible without prejudice to natural regeneration. Artificial regeneration is rejected as a system, mainly on economic grounds. The difficulties of afforesting waste land and poor grazing, and of converting unprofitable coppice stands are discussed.

33.3 (43). HERZNER, R. A. **Changes in the chemical uses of wood in the last decade.** *Centralbl. f.d.g. Forstw.* 64, 1938 (153–65). [G.]

A general survey of the development of the chemical uses of wood in Germany and Austria during the last decade, including the manufacture of alcohol, sugar, carbohydrate foodstuffs, paper pulp, artificial silk and artificial wool, and the by-products of such manufacture. From the forestry standpoint in these countries, the most promising of all the old and new methods of utilizing wood and its waste products are the production of artificial wool, the saccharification of wood, and the production of gas from wood waste and timber of lower grades. The author predicts an increasing interest in Beech as a raw material for artificial wool.

33.3 : 31.3 : 07.2 (485). BERGSTRÖM, H. Kolningslaboratoriets Verksamhet 1907–37. **[Activities of the Institute for Wood Chemical Research during the period 1907–37.]** *Reprint* from *Teknisk Tidsskrift* 1938, No. 49. pp. 17. [Sw.]

The work of this Institute has been directed chiefly to ways and means of utilizing wood, by-products of wood, and peat. Particular objects of investigation have been the manufacture of charcoal, the fractionation of crude distillates and of waste products from cellulose production, the purification of effluent water from cellulose factories, and the production of solid and liquid motor fuels derived from wood or peat. About 160 technical papers have been published, the titles of which are given in a list of publications appended to the article.

33.32. MOLDOVANU, I. **Beech wood for the manufacture of cellulose.** *Revista Padurilor* 50, 1938 (682–90). [Rou.f.]

This article explains the properties required in Beech wood to be used in the manufacture of artificial silk and lays down certain essential rules to be observed in the exploitation of the stands.

33.32 : 33.1. MAYER-WEGELIN, H., MARSCHALLECK, B., GELINSKY, H., and JUNACK, H. **Investigations into the conversion in the forest of Beech timber for the manufacture of cellulose.** *Mitt. Forstwirt.* 1938 (121–38). [G.g.]

The technique of barking, splitting, and storage, and the factors affecting the efficiency of barking are discussed in a particularly thorough study in labour economics. The percentage of

Species	Width of fibre			Length of fibre		Specific gravity (air-dry)
	Min.	Max.	Average	Min.	Max.	Average
Musanga smithii	0·052	—0·104	0·076	0·6	—1·7	1·1	0·13
Ricinodendron heudelotii	0·04	—0·1	0·07	1·1	—2·0	1·5	0·21
Poplar	0·011	—0·03	0·018	0·67	—1·72	1·14	0·39—0·59
Canarium schweinfurthii	0·014	—0·025	0·02	0·8	—1·8	1·3	0·44
Terminalia superba	0·007	—0·033	0·016	0·75	—1·87	1·15	0·54
Lannea welwitschii	0·015	—0·078	0·022	0·58	—1·59	1·09	0·52
Eucalyptus	0·0074	—0·015	0·011	0·35	—1·42	0·91	0·7 —1·0
Pycnanthus kombo	0·011	—0·044	0·024	0·9	—2·5	1·6	0·48
Beech	0·007	—0·011	0·01	0·5	—1·55	0·8	0·66—0·83
Rhizophora mangle	0·007	—0·02	0·015	1·6	—2·0	1·9	1·05
Chlorophora excelsa	0·005	0·018	0·011	0·9	—1·9	1·4	—

loss through 'deep' barking (Weissschälen) is assessed at 7–8 per cent. Under average conditions and with material of medium quality a workman can bark 3–3·5 cubic metres in 8 hours.

33.32 (6). MÜHLSTEPH, W. **Cellulose from colonial timbers.** *Kolonialforstliche Mitteilungen* 1, 1938 (179–84). [G.]

Fibre width, rather than length, of the cellulose material examined, which was extracted by means of caustic soda and without grinding, bore a simple relation to 'strength as determined by touch'. The table above gives figures for soda pulp arranged in decreasing order of strength.

Comparisons of the merits of chemical fibre obtained from African timbers are not reliable unless each timber has received its particular optimum treatment. The possibilities of pulp production from mixtures of several African timbers should be studied.

33.32 (71). FREEMAN, H. **Southern Pine newsprint *versus* Canadian newsprint.** *For. Chron.* 14, 1938 (88–93).

The author questions whether newsprint from Southern Pine can compete with Canadian newsprint in the near future. Canada's objective should be to develop a large cellulose and chemical industry and to conserve its forest resources.

33.32. HOYER, F. **Can Bamboo prevent an imminent scarcity of cellulose?** *Zeitschr. f. Weltf.* 5, 1938 (469–90). [G.e.]

Bamboo has long been used in the East for paper making. The quality of the paper produced has generally been poor, but with modern methods it is possible to produce high-grade cellulose suitable not only for paper but also for further chemical conversion. Owing to its very rapid growth, which may permit of a rotation as little as 3 or 4 years, bamboo is a specially promising source of raw material. Five widely distributed species are mentioned as suited for cultivation. The difficulties encountered in transporting green bamboo, which is unwieldy and perishable, may be overcome by a process of partial conversion before shipping. In this process a fibre concentrate is prepared and pressed into bales, 600 kg. of concentrate occupying a space of only 1 cu. m. All the usual conversion processes may now be applied to the production of high-grade cellulose from bamboo.

33.36 : 31.42.1 (43). ROHMEDER, E. **Experiments with a preventive against Beech rot.** *Forstw. Centralbl.* 60 1938 (329–32). [G.]

A new preventive of Beech Rot manufactured by the 'Chemische Fabrik Marktredwitz' was tested by the Munich Institute for Silviculture and Forest Utilization. It was found that butts, and other portions of felled stems not protected by the bark, which had received a coating of 'Marktredwitz' resisted attack by Beech Rot when left lying for a year in the forest much better than untreated stems under the same conditions; and that losses from Beech Rot, assessed on conversion, amounted to 8 per cent. in the former and 39 per cent. in the latter. The effect of the treatment, at least in the case of spring fellings, was found to depend on the immediate application of the product.

33.36 (213). BAVENDAMM, W. **Timber preservation in the tropics.** *Kolonialforstliche Mitteilungen* 1, 1938 (169–74). [G.]

A comprehensive review of the main contributions on the subject. Twenty-six papers are mentioned in the bibliography, most of the material in which is in English.

33.36 (91). WALKER, F. S. **Air seasoning of Rengas timber (*Melanorrhea* spp.).** *Mal. For.* 7, 1938 (136–7).

In seasoning experiments at the Sentul Timber

Research Laboratory, ½–1 in. boards of Rengas reached air-dry condition (12–16 per cent. moisture) after 3 months. 1½ in. boards required an extra week or two. It is considered that 4 months should be enough to dry 2–2½ in. planks to a moisture content of 20 per cent. Shrinkage was very slight, and 1-in. boards shrank only 1·1 per cent. between 43 and 13 per cent. moisture content.

33.36 (91.4). MIRANDA, J. **Air-drying rate of one-inch boards of different widths of White Lauan (*Pentacme contorta* (Vid.) Merr. & Rolfe) and Bagtikan (*Parashorea malaanonan* (Blanco) Merr.).** *Philip. Jnl. For.* 1, 1938 (89–96).

One-inch boards of White Lauan and Bagtikan reached their equilibrium moisture content under shade in 210 and 231 days respectively. The air-drying rate of these boards was not affected by width.

33.36 (94). ELLIOT, C. S. **A decade of progress in kiln seasoning in Australia.** *Emp. For. Jnl.* 17, 1938 (84–7).

During the past 9 years the Division of Forest Products in Australia has encouraged the development of kiln-seasoning by propaganda and advice on all questions relating to kilns and their operation. The Division has taken great pains to secure the co-operation of the timber industry, with the result that Australia now has 400 kilns in constant operation for the output of seasoned material to meet local demands, as compared with the 40–50 that were working in the face of considerable prejudice at the beginning of the period.

33.36. BATESON, R. G., and HODGE, R. E. **Kiln-drying schedules.** *Dept. of Sci. and Ind. Res., Forest Products Research Records* No. 26 (Seasoning Series No. 5). 1938. pp. 21.

Eight schedules have been compiled to show the proper treatment of 178 timbers. An alphabetical list of the commercial and botanical names of the species refers each to its appropriate schedule. The paper also contains a short discussion of factors involved in kiln-drying and of the correct method of operating kilns.

33.36 : 32.31 (54). TROTTER, H. **Treating fence posts by means of old inner tubes.** *Ind. For.* 64, 1938 (551–5).

Describes a cheap and simple method of treating green fence posts and other round green timber with water solution preservatives, by using pieces of old motor-car inner tubes attached to one end of the posts. The method described is a simple modification of the well-known Boucherie process, and is well suited for fencing operations in the forest. *Author's summary.*

33.36 : 33.31 (68). WYK, J. H. VAN, and VERWOERD, L. **The toxicity of South African creosote.** *Jnl. S.A. For. Assn.* 1, 1938 (47–50).

The gravimetric method of toxicity determination is described. Its application by the writers to fungi-infected wood treated with creosote produced at the Iscor Works, Pretoria, reveals a toxic limit for that product at least as high as that of standard imported creosotes. *Author's summary.*

33.36 : 31.4. KNIGHT, R. A. G., and ARMSTRONG, F. H. **Kiln-seasoning treatments of Teak and their effects on its wearing qualities as flooring.** *D.S.I.R., Forest Products Research Records* No. 23. 1938. pp. 14.

An account is given of 6 kiln-seasoning experiments on Teak strips 4 in. wide by 1 in. thick, in which the temperatures used ranged from 45° C. (113° F.) to 95° C. (203° F.) and of the effect on the floor-wearing qualities of the material of kiln treatments at 95° C. and at 45°–60° C. (140° F.) (varying).

It is concluded that the principal factor influencing the choice of drying schedule is the characteristic variation of moisture content in the timber as received in this country, since splitting, warping, shrinkage, &c., are not affected by the particular treatment, and colour, though changed in the kiln, quickly re-establishes itself on exposure to light and air. The floor-wearing qualities of the Teak were not affected by the use of kiln temperatures of 95° and 45°–60° C. (varying). *Author's summary.*

33.36 : 31.42. FINDLAY, W. P. K. **Decay of timber and its prevention.** *D.S.I.R., Forest Products Research Records* No. 27 (Mycology Series No. 3). 1938. pp. 15.

Timber does not deteriorate with age; its decay is brought about by fungi which require damp but not waterlogged conditions for growth. Fungal infection by means of minute spores is so widespread that timber must be kept in such a way that this infection does not develop. Felled logs should be converted as soon as possible and sawn timber should be stacked so that the surface at least can dry off quickly. Timber

yards should be kept clean and free from decaying wood waste, from which fungi will spread. Timber in service which cannot be kept permanently dry should be thoroughly treated, preferably by impregnation, with a wood preservative. Valuable woodwork infected with decay may be sterilized by a short heat treatment at a high humidity in a drying kiln. *Author's summary.*

33.36 : 32.32.1 (54). SCOTT, C. W. **Creosoted wooden railway sleepers [ties] in India and elsewhere.** *Railway Board Techn. Paper* No. 306. 1938. pp. 50.

About half the wooden sleepers used by the Indian railways are untreated Sal [*Shorea robusta*], lasting for 12 to 16 years if free of sapwood in vital parts and free of pith or centre heart [boxed heart]. Sleepers cut to this standard are apt to be expensive and difficult to procure without causing undue friction with suppliers and increasing heavy freight for long rail haulage. Indian practice with untreated and treated sleepers is compared with that of other countries and especially with developments in Great Britain and America. In the U.S.A., where nowadays over 90 per cent. of all sleepers are treated, the extension of the practice of creosoting was the chief cause of a drop of 64 per cent. in annual renewals between 1911 and 1935. Detailed suggestions are made regarding tests to determine the life of creosoted sleepers of Sal and other species in India for which data are lacking; and also for comparative studies of the cost of the ordinary type of untreated sleeper hitherto used in India and the type of hardwood sleeper with boxed heart used in America.

33.38 (4). KLAR, M. **Present day position of charcoal making technique.** *Holz* 1, 1938 (139–45). [G.g.]

The former system of charcoal-burning in its simplest forms is contrasted with the modern industrial technique of dry distillation, in which charcoal is merely one of a whole series of useful products such as acetic acid, acetone, &c. Many refinements of technique have been necessary to enable the industry to compete with synthetic products derived from other sources. After a brief review of the present extent of dry distillation in the world generally and Europe and Germany in particular, the greater part of the article is devoted to modern factory technique, with special reference to Beech wood and to the processes and equipment used for obtaining the various products. The account is illustrated by a series of diagrams.

33.38. **Notes on progress in the use of producer-gas in the French colonies.** *Rev. int. prod. col.* 13, 1938 (232–6). [F.]

A special apparatus known as the 'By-Pass' and devised by Renault prevents loss of output in the generators of lorries run on producer-gas during long descents. Recent improvements in Renault lorries enable the direct use of uncarbonized wood of any kind, provided that the pieces do not exceed 12 cm. in size and 30 per cent. in moisture content. The wood may be mixed with a certain proportion of sawdust, &c. A 2,500-kg. lorry of this type does 100 km. on 70 kg. of fuel.

33.38 (67.1). JOLY, M. L. **The economic use of producer-gas in the Cameroons. Charcoal from coconut shells—an ideal fuel.** *Rev. int. prod. col.* 13, 1938 (230–2). [F.]

Charcoal from coconut shells is recommended to colonists in the Cameroons as an ideal fuel for generators. It has the purity of wood charcoal, but it also has a high apparent density (55 kg. per hectolitre). Also it consists of small pieces (below 2 cm.) and is resistant to crumbling. Such charcoal has been used by the author for making producer-gas both on his plantation and for his lorry. The requirements of an ideal lorry to run on this fuel are outlined.

33.38. MILLET, A. **Notes on the use of producer gas.** *Bull. Com. For. Paris* 11, 76, 1938 (643–8). [F.]

Charcoal is preferable to wood as a source of producer-gas. The financial advantages of running lorries on producer-gas are discussed, and a recommendation is made that lorry drivers should be given a small bonus to compensate them for the extra work involved in cleaning the generator.

33.38. DONALD, G. H. **Wood and charcoal as motor fuels.** *Emp. For. Jnl.* 17, 1938 (70–4).

From the performance of 'gazogenes' at a demonstration rally organized by the French Departments of Agriculture and Forestry, the author concludes that vehicles driven by producer-gas could be of great service where liquid fuels are expensive and wood is readily available, and might also find a use in times of national emergency.

33.38 (44). ROMANET, A. DE. **Improvements in the technique of charcoal production.** *Bull. Com. For. Paris* 11, 76, 1938 (648–67).

The reason for the prohibitive cost and poor quality of charcoal as compared with other motor fuels in France is to be sought in wasteful and inefficient methods of conversion, coupled with the fact that the older processes cannot utilize the enormous amount of felling refuse and wood of small dimensions, which is mostly burnt or left to rot in the forest.

The modern 'Autocarbon' equipment, first designed by J. Gohin and further developed by the author, yields up to 33 per cent. of clean charcoal of high quality and can be fed with wood of widely varying dimensions, including felling refuse. In addition to charcoal, it can produce either gas of high calorific value or tar and other liquid products. The equipment consists of a cutter for reducing wood, branches, &c., into a form suitable for conversion; a special closed oven; a machine for preparing the charcoal; and various accessories. The plant is started by an auxiliary producer-gas generator, but once in action runs automatically on its own gas. There are two models, one stationary and the other mounted on a trailer for use with a lorry. A detailed analysis of yields and costs of running shows that the apparatus can produce charcoal profitably at about two-thirds of the present price.

33.38 : 35.8 (54.5). CHOPRA, R. S. **Charcoal-burning in irrigated plantations.** *Ind. For.* 64, 1938 (345–50).

During the past few years there has been a glut of firewood in the south-western parts of the Punjab, owing to the wholesale clearance of large areas of dry scrub for colonization. Under these conditions charcoal-burning has been increasingly practised as a means of disposing of unprofitable stocks of firewood produced on the irrigated plantations of the Forest Department. The author describes the kilns and methods of burning employed in these plantations, and discusses the yield of charcoal and the financial possibilities of the industry.

33.4 (73). DIETZ, A. G. **Laminated Spruce and Greenheart beams.** *Trop. Woods* No. 56, 1938 (1–5).

Tests conducted at the Massachusetts Institute of Technology on small composite beams of eastern North American Spruce and Greenheart showed that strong and stiff beams can be made up of a comparatively small amount of Greenheart combined with a fairly large proportion of considerably lighter, poorer-grade material.

33.8 (54.5). KAPUR, S. N. **Notes on some woodworking industries in the Punjab.** *Ind. For.* 64, 1938 (401–19).

With a change in Indian requirements due to the effect of Western civilization, a number of new woodworking industries have sprung up in the Punjab, such as the manufacture of wooden heels for ladies' shoes, gramophone and radio cabinets, bobbins, shuttles, and other requirements for hand and power looms, picture-frame mouldings, electrical casings, &c. Some of these newly developed industries are briefly described in the paper, discussing their economic aspects, and indicating the woods that have been found suitable for particular purposes. It is suggested that a country-wide survey of the existing woodworking industries should be carried out, to collect information on their technical and economic features, in order to be able to further their growth, and to introduce new industries in the country. *Author's summary.*

33.8 (54). LIMAYE, V. D. **Wood for sports goods.** *Ind. For.* 64, 1938 (482–5).

Manufacturers of sports goods in India are becoming interested in the use of Indian woods. Woods that are or might be suitable for manufacturing sports goods of various kinds are briefly reviewed.

34. *Minor Forest Products*

34.24 (65). **The tannin content of the wood and bark of some Algerian forest trees.** *Algeria Stn. Rech. For. Bull.* 2, 1938 (490–6). [F.]

A particularly high tannin content was found in *Quercus mirbeckii* Dur.

34.24 (65). DORNE, M. **Cork in Algiers—(1) Cork harvest; (2) Manufacture of cork; (3) Cork market.** *Revue Internationale du Bois* 5, 1938 (265–70). [F.]

The Cork Oak forests of Algeria occupy 440,000 ha., the areas occupied in other countries being: Portugal, 600,000 ha.; Spain, 340,000 ha.; Italy, 75,000 ha.; Morocco, 300,000 ha.; Tunis, 140,000 ha.; France and Corsica, 150,000 ha. The total, including Algeria, amounts to 2,045,000 ha. In Algeria nine-tenths of the cork production is in the Constantine department. In 1937 the total cork harvest amounted to 533,916 quintaux (1 quintal = 100 kg.), of which 182,890 quintaux, representing a value

of 25,300,000 francs, were obtained from State and Communal forests. This was an exceptionally good year as the average production in Algeria is 1 quintal per ha. per annum.

Cork has been exported from Algeria as a raw material since the beginnings of the French conquest, but considerable development of local cork-working industries took place only in post-war years. These undertakings consist of 'preparation' factories, which are concerned mainly with the production of cork boards and often also with the conversion of waste material, together with 'male' cork, into cork-grain and powder; and factories producing finished goods, among which cork stoppers occupy the most important place.

In the years 1935, 1936, and 1937 France imported 134,245, 141,501, and 145,411 quintaux of Algerian cork respectively. Other principal importers of Algerian cork are (in descending order of importance) the U.S.A., Germany, Belgium-Luxembourg, and Holland. Recently the industry has suffered somewhat owing to an increase in wages and freight rates and to the considerably augmented exports of Nationalist Spain to Germany and the Northern Countries. A general description of the harvesting and conversion of the raw material is given in the paper.

34.25 : 12.27.16. PUNTAMBEKAR, S. V. **Commercial possibilities of a new detergent and some related lauryl compounds.** *Ind. Chem. Soc. Industrial and News Edition.* (C) 1, 1938 (19–24).

The ideal detergent properties of sodium lauryl sulphate and the important uses of some related lauryl compounds are described, and a suggestion is made that lauric acid, the basic material for the manufacture of these valuable compounds, could be obtained more profitably from the fats of several indigenous species of *Actinodaphne* and *Litsaea* (Fam. *Lauraceae*) than from coconut and palm kernel oils. Physical and chemical constants of the fats from the berries of *Actinodaphne hookeri*, *A. angustifolia*, *Litsaea chinensis*, *L. zeylanica*, *L. citrata*, and *Cinnamomum camphora* are given in a tabular form. *From Author's abstract.*

34.26 (921). ROWAAN, P. A., and GONGRIJP, J. W. **An examination of the balsams of various species of Pinus from North Sumatra.** *Tectona* 31, 1938 (876–80). [Du.e.]

The balsam of *P. merkusii* is preferable to that of *P. insularis* or *P. khasya*, as it contains more turpentine and as the turpentine and colophony it yields are of a better quality. *P. merkusii* is therefore the most useful species from the economic standpoint.

34.26 (43). KIENITZ, G. A. **Obtaining resin on saccharifying wood.** *Holz* 1, 1938 (293–6). [G.g.]

A description of the simplified (Stralsund) method devised by K. F. Wilhelm for extraction of resin by means of turpentine in vaporized form. This solvent penetrates wood tissue much more readily than others hitherto employed, and it is suggested that the method might profitably be used in conjunction with the ordinary process of wood saccharification with a view to the recovery of resin as a by-product.

34.26 (43.1). LOYCKE, H. J. **The use of chemical irritants in the large-scale production of resin from Scots Pine.** *Forstarchiv* 14, 1938 (269–86). [G.g.]

The use of a 25 per cent. solution of hydrochloric acid as an irritant in the large-scale production of resin from Scots Pine was tested in 1937 in Meseritz, Schönlanke, and Bütow (Prussia) on roughly 350,000 trees. This large-scale experiment was preceded by thorough preliminary work on the technical reorganization demanded by the new method, after investigations had shown its suitability on sites and in stands differing from those of the Forstamt Kobbelbude near Königsberg, where it had been devised and tried out on a small scale by Professor Dr. Hessenland and his collaborators. The large-scale experiment of 1937 showed that the resin obtained did not differ externally from resin tapped without the help of an irritant, but that the resin showed a tendency to crystallization which may prove a disadvantage for a few of the purposes for which it is utilized. On the other hand, mainly as a result of an increase in yield of roughly 60 to 70 per cent., the cost of production was reduced, according to the quality of the stands, by 7–15 pfennigs per kg. of raw material. The advantages of the new method cannot be definitely established until further experience has shown that the cost of distillation and the selling price of the raw material remain unaltered by the new method, and that the latter has no detrimental effect on the trees from the standpoint of silviculture and of the utilization of the timber.

34.26 (44). OUDIN, A. **Studies on the resin-tapping of Pines in France.** *Ann. Ec. Nat. E. & F. Nancy*, 7, 1938 (167–291). [F.e.g.]

A general survey of the subject. While the

species regularly exploited are the Maritime and Aleppo Pines, some experimental tapping is being attempted with Corsican, Austrian, and Scots Pine. It is also hoped that silvicultural and technical experiments in progress will make it possible to increase money yields while adhering to the established 'Hugues method' of resin-tapping.

34.6 (43). KRÄSS, A. **Occurrence and utilization of wood waste.** *Holz* 1, 1938 (169–72). [G.g.]

The importance of utilizing wood waste is emphasized in a tabular comparison of the estimated quantities of waste and the annual timber consumption of German industries for 1936. It is estimated that the available waste would have been nearly 11 million cu. m., or about a quarter of the total timber consumed. Of this approximately 7 million cu. m. were probably used on the spot for power and heating in the factories, but the author points out that improved methods would probably render other forms of utilization more economical. Various types of wood waste and the possibilities of their utilization are discussed, and it is suggested that future important uses will include cellulose manufactures, saccharification, and the production of wallboards and other miscellaneous products.

35. *Sale and Disposal. Timber Trade*

35. COLLARDET, J. **French colonial forest production in 1937.** *Rev. int. prod. col.* 13, 1938 (377–86).

Exports from the West Coast of Africa (Ivory Coast, Gaboon, and the Cameroons) totalled 578,647 (metric) tons of timber in 1937 as compared with 389,627 tons in 1936. Exports from Indo-China increased from 15,089 tons in 1936 to 24,800 tons in 1937. About 375,000 tons of French colonial timbers—170,000 tons more than in 1936—were bought by foreign countries, though home imports increased by only 25,000 tons. Germany remained the principal importer; in Great Britain, Holland, Belgium, and particularly in the U.S.A., consumption has increased, while Italian imports continued to diminish. The various causes which led to the remarkable increase of exports in 1937 and the special market conditions prevailing in the importing countries are discussed.

37. *Transport*

37.1 (47.1). KOSKENMAA, E. J. **The importance of the road system in State forests.** *Silva Fenn.* 46, 1938 (72–83 and 239–40). [Fi.g.]

The main obstacle to the improvement and extension of the road system in State forests is the low density of population in the principal regions of Finland in which these forests occur.

38. *Constructional Works*

38.8 (43). KELLER, E. **Living barrages in river control.** *Centralbl. f.d.g. Forstw.* 64, 1938 (181–93). [G.]

The merits of Fr. Stellwag Carion's method ('Suitability test for cuttings', *Centralbl. f.d.g. Forstw.*, 1936, vol. 62, No. 7/8), are briefly discussed. Different types of living barrages of Willow used in the control of the river Enns are described and their merits discussed.

4. PROTECTION

43. *Forest Fires*

43 : 11.41 : 11.47.6 (73). HEYWARD, F. **Soil temperatures during forest fires in the Longleaf Pine region.** *Jnl. For.* 36, 1938 (478–91).

Soil temperatures at depths of $\frac{1}{8}$–$\frac{1}{4}$ in., $\frac{1}{2}$ in., and 1 in. were recorded during 44 experimental fires in various types of Longleaf Pine forest. The records show that the heating effect decreases rapidly with depth: in one fire a maximum of 313° F. at $\frac{1}{8}$ in. was accompanied by maxima of 178° and 153° F. for the $\frac{1}{2}$ and 1 in. levels respectively. At $\frac{1}{8}$–$\frac{1}{4}$ in. from the surface the majority of readings ranged from 150° to 175° F., and temperatures over 200° F. were infrequent. No temperature recorded approached the charring point for dry organic matter in the soil. Previous literature is said to show that heating up to boiling-point increases the concentration of ammonia and soluble salts in the soil, but higher temperatures result in a decrease of fertility. It is therefore suggested that in the region dealt with forest fires may do no material harm to the soil, and may even increase fertility under certain conditions. Other effects, however, need study before such questions can be answered in detail.

43.1 (42). RYLE, G. B. **The protection of plantations against fire.** *Forestry* 12, 1938 (65–79).

The different aspects of fire-protection of young plantations are discussed, and the necessity is stressed of making provision, at the time

when plantations are formed, for the fire-protection of the grown forest.

43.11 : 44.1 (79.4). IKENBERRY, G. J., BRUCE, H. D., and CURRY, J. R. **Experiments with chemicals in killing vegetation on fire-breaks.** *Jnl. For.* 36, 1938 (507–15).

The Californian Forest and Range Experiment Station has investigated methods of stump poisoning and soil sterilization with a view to discovering economic means of maintaining fire-breaks free of vegetation. The experiments show that more than 85 per cent. success in stump poisoning may be attained by the use of sodium chlorate, sodium arsenite, or Diesel oil. The most economical and effective substances for soil sterilization were found to be sodium arsenite, arsenic trioxide, sodium chlorate, and borax. None of these is effective against all plants when used alone; but sodium arsenite in a 2 to 4 mixture with sodium chlorate, applied in the quantity of 6 lb. per square rod, sterilized the soil effectively against a vast majority of the plants found on Californian fire-breaks. The authors point out that certain dangers attend the use of some of the substances mentioned.

44. *Protection against Damage by Harmful Plants*

44.1. **The effect of Lalang on the growth of young Rubber trees.** *Jnl. R.R.I. Mal.* 8, 1938 (227–31).

The experiments described definitely confirmed the widely held view that Lalang seriously retards the growth of young Rubber trees, but it was not possible to arrive at any conclusion whether the effect was due to competition for moisture and/or soil nutrients, or to some other cause.

44.3. RADULESCU, A. **The appearance of Larch canker in Rumania.** *Revista Paduri-lor* 50, 1938 (661–7). [Ru.f.]

The appearance of Larch canker in the 25–40-year-old plantations of the upper Prahova valley is attributed mainly to the fact that the seed employed has been imported from much higher elevations in Tyrol.

45. *Protection against Damage by Animals*

45.3 (43). HOFMANN, C. **Experiments with a new contact poison for forest pests.** *Zeitschr. f. angew. Entom.* 25, 1938 (381–96). [G.g.]

Laboratory results indicated that preparations '2152' and '2172' of the 'I.G. Farbenindustrie' were very effective against *Lymantria monacha* and *Bupalus piniarius*, whereas no harmful effect on plants, warm-blooded animals, and bees, could be detected. Field experiments on a large scale are required before the new preparations can be adopted for such purposes as aeroplane spraying.

5. INCREMENT. YIELD

5 (485). HAGBERG, N. **Valuation-survey analyses of the mixed forests of Central Sweden.** *Sven. Sk. Tids.* 36, 1938 (385–511). [Sw.g.]

A full statistical analysis is presented of yield and increment in more or less even-aged mixed stands of Pine (about 50 per cent.), Spruce (40–5 per cent.), and Birch and other hardwoods (5–10 per cent.). The material dealt with consists of 24,000 sample trees from the State valuation survey of 1923–9. Stock density, diameter, basal area, height, form factors, volume, percentage volume increment, &c., are considered, and the results are analysed separately under age and diameter classes, species, and site quality. From these results yield tables have been compiled. Analysis was restricted to site-classes III, IV, and V, in which the maximum yield capacity from the most suitable species on a 100-year rotation is estimated respectively at 600, 450, and 340 cu. m. per hectare.

51 : 52.22.1. STOFFELS, A. **On the accuracy of some simple hypsometers working without measurement of the distance from the instrument to the tree.** *Zeitschr. f. Weltf.* 5, 1938 (491–9). [G.e.f.]

The advantages of three types of hypsometer (Christen, Hub, and Vorkampff-Laue) are compared with particular reference to their accuracy in actual use. Errors occur in the height of the tree as found by the instruments and in the reading of the scale by different observers. These errors are discussed and analysed in tables and equations. The author concludes that the Christen hypsometer generally gives

the best results and is quicker in operation than other types. In addition, the use of a 5-m. instead of a 4-m. picket is said to reduce the errors considerably.

52.43.32 : 12.27.39 (91.4). MANALO, T. J. **A commercial volume table for Tiaong (*Shorea teysmanniana* Dyer).** *Philip. Jnl. For.* 1, 1938 (171–97).

The table is based on an 'alinement chart' and gives the merchantable volume of Tiaong in Northern Laguna (Pāngil) in relation to stump diameter and height of the merchantable part of the bole. The construction of the alinement chart is explained in detail and the reliability of the data is confirmed by a statistical test.

52.43.5. Technische Einzelheiten bei der Aufnahme von Versuchsflächen. **[Technical details in the enumeration of sample-plots.]** Preussische Versuchsanstalt für Waldwirtschaft, Eberswalde. 1938. pp. 12.

Includes conventional signs for the description of stem- and crown-classes and of tree-shape, and short notes on crown-measurement and on sample plot photography.

52.43.5. WIEDEMANN, E. Anweisung für die Aufnahme und Bearbeitung der Versuchsflächen der Preussischen Forstlichen Versuchsanstalt. **[Instructions for the enumeration of sample-plots of the Prussian Forestry Research Institution.]** Neudamm. 1938? pp. 47.

The instructions deal concisely with (i) first enumerations (simplified and detailed), (ii) repeated enumerations, (iii) the treatment of 'missing' and 'traced' stems, (iv) the distribution of the work among the personnel, and (v) the recording of data. Examples of tables, forms, and graphs are appended.

56 : 07.7. KRAUSS, G. **A cutting machine for the preparation of Pressler wood sections.** *Thar. For. Jahrb.* 89, 1938 (436–41). [G.]

The special microtome devised by the author facilitates the preparation of tangential and radial sections of entire wood cylinders obtained by 'Pressler's' Borer. These sections, when mounted on sheets of paper, can be conveniently used for study and comparison.

56.22 : 57.13 : 64 : 65 (73). DUERR, W. A., and GEVORKIANTZ, S. R. **Growth prediction and site determination in uneven-aged timber stands.** *Reprint* from *Journal of Agricultural Research* 56, 1938. pp. 81–98.

A method is presented for determining site and predicting growth in uneven-aged timber. Taking advantage of the fact that a main even-aged group of trees may be distinguished within each uneven-aged stand, the basal areas of stands are curved over the ages of these main groups, and these curves are used in conjunction with the ratio of volume to basal area in predicting future yields and growth. Site is introduced as a function of age and average diameter. This series of relationships may be expressed in the form of site and growth tables, which can then be applied to any stand of the cover type in question.

A statistical analysis of the field data obtained in the northern-hardwood cover type shows that (1) use of the three correlations—basal area with average diameter, volume basal-area ratio with average diameter, and age with average diameter—as a basis for growth prediction, is well justified; (2) significant, even-aged groups of trees are actually present in so-called 'uneven-aged' stands; (3) only a small error is involved in determining the average age of these groups, this error depending upon the number of age-sample trees bored on each plot. *Author's summary.*

57 (213). GRÜNWOLDT, F. **On methods and results of yield investigations in tropical rain-forest.** *Kolonialforstliche Mitteilungen* 1, 1938 (222–7). [G.]

The researches of Burger suggested that, under equal conditions, the different Swiss and German species produced the same amount of organic matter measured in weight of dry material. Should this hypothesis hold good for the tropics, it would be sufficient to know the growth conditions of one species and the specific weights of the wood of the remainder in order to deduce the approximate volume yield capacity of the latter. It has also been suggested, on the other hand, that some regularity exists in the increase of production of organic matter from the northern and the southern forest limits, respectively, to the equator. Assuming that this suggestion as well as Burger's hypothesis should prove correct, it should then be possible to find a numerical relation between a given latitude and the productive capacity in vegetable matter of the site factors of that latitude. This relation, which may be termed 'the increment potential' (Zuwachspotential) of the latitude, might then

be used as a check on the volume yield capacity deduced as above. The theoretical volume yield capacity thus obtained would be very helpful pending the availability of more reliable data from actual sample plots.

The special problems involved in the investigation of yield in the tropics are discussed and mention is made of a few results obtained in West Africa, India, and the Dutch Indies. The author himself enumerated one sample plot of 6½-year-old Umbrella trees (*Musanga smithii*) during the expedition of Prof. Heske to the forests of the Gulf of Guinea in the winter of 1936–7, and found an approximate 'Derbholzfestgehalt' (true volume of all wood of over 7 cm. diam. at the smaller end) of 230 cu. m. per ha.

57.9. FEKETE, Z. **The right interpretation of stock- and crown-density.** *Erdészeti Lapok* 77, 1938 (841–50). [Hu.g.f.e.]

As crown density is much easier to estimate than stock density, it is usually substituted for the latter in the practical application of yield tables. This substitution does not lead to serious inaccuracies in the case of Beech and Hornbeam, but the author considers it inadmissible for Locust and Oak. For these species two tables are given, from which the ratios of stock density to crown density and site class can be obtained, and the construction is advocated of similar tables for other species where required.

57.9 : 24.25. SMYTHIES, B. E. **Pyinkado (*Xylia dolabriformis*) yield tables—a first approximation.** *Ind. For.* 64, 1938 (257–69).

These yield tables, based on measurements from temporary and permanent sample plots in the Tharrawaddy division, are not empirical but theoretical, i.e. they give ideal or 'normal' figures attainable by the use of a suitable thinning system. Since past thinnings have been inadequate, few plantations reach these figures, the nearest approach being shown by the permanent sample plots, which have undergone the most careful thinning. Pyinkado is grown as a pole crop and branchiness is undesirable; hence thinnings heavy enough to produce the maximum diameter increment may have to be reduced in practice to keep down branches. In view of this the tables are to be used with caution.

57.9 : 12.25.53 (73). MEYER, W. H. **Yield of even-aged stands of Ponderosa Pine.** *U.S. Dept. of Agric. Technical Bulletin* No. 630. 1938. pp. 59.

Notes on the distribution and ecology of *P. ponderosa* in the U.S.A. and detailed information on its growth and yield, including yield tables, stand and stock tables, height tables, mortality tables, and volume tables.

6. MANAGEMENT. WORKING PLANS. SURVEYS

6 (43.1). MERTEN. **Notes on the stock survey of the Prussian State Forests: experiences and suggestions.** *Zeitschr. F. & J.* 70, 1938 (609–30). [G.]

The author discusses various difficulties in applying the prescriptions of the official stock survey. Special emphasis is laid on the laboriousness and inordinate expense of full caliper measurements of mixed and uneven-aged stands, and on the fact that the haste with which the work had to be completed necessitated the employment of insufficiently trained staff. Supervising officers often left on account of the inadequate salaries paid, or were transferred to other districts before their work was completed, and much needless duplication of effort was the result. The calipering staff was recruited hastily from very diverse sources, and many of the men employed were incompetent. Apart from various technical recommendations, the author suggests that the survey should continue with a properly trained staff, even if this means slowing down the progress of the work.

61.3 (73). WILCOX, F. R. **The use of aerial photogrammetry and aircraft in woods operations.** *Jnl. For.* 36, 1938 (1038–44).

A brief survey is made of the use of aircraft in forestry. Present uses fall under seven main heads: map-making, timber estimating, forest protection, forest improvements [reconnaissance surveys for roads, &c.], estimation of logging costs, transport, and miscellaneous uses.

61.3. GUISLAIN, A. **Aerial photography and aviation in the service of forestry.** *Rev. E. & F.* 76, 1938 (485–92). [F.]

The merits and limitations of surveys by aerial photography are discussed: they are considered most useful in mountainous country.

Co-operation between forest and other services concerned with aerial photography is suggested, and mention is made of the uses of aviation in insect and fire control.

61.3. **Aviation employed in the reconnaissance of colonial forests.** *Rev. int. prod. col.* 13, 1938 (224–6). [F.]

Experience in aerial reconnaissance of forests in French Equatorial Africa, French West Africa, and Madagascar has proved the usefulness of the method, especially for preliminary surveys. In French West Africa, where surveys were carried out by the military air establishment, the cost was only 250 fr. per flying hour.

61.3 (71). SEELEY, H. E. **Air photographs as used by the Dominion Forest Service.** *Jnl. For.* 36, 1938 (1035–8).

A brief description of the use made of air photographs by the Canadian Forest Service. Aerial photogrammetry is employed mainly to reduce the cost of broad forest inventories. Once an area has been mapped, special forest inventory photographs taken by steep-oblique photography are found most useful for bringing maps up to date. The Service has developed a special double-vision projector for transferring detail from photographs on to maps.

61.3 : 12.19 (728.2). STEVENSON, N. S. **The evolution of vegetation survey and rural planning in British Honduras.** *Emp. For. Jnl.* 17, 1938 (9–26).

This article reviews the progress made since 1920 in accumulating data on vegetation, soil, topography, and climate in British Honduras. The first object of the surveys was to investigate forestry possibilities, but the information collected has proved of much wider usefulness. Vegetation types are useful indicators of soil quality, and the information collected on vegetation and soils will be of great value in planning future rural development. Throughout the work there has been close co-operation between the forestry department, the agricultural department, and other bodies concerned with rural development as a problem in common.

61.4 (91). WATSON, J. G. **Topographical maps**—preparation and processes of production. *Mal. For.* 7, 1938 (180–4).

The preparation of topographical maps is discussed and the processes involved in the production of 1-in., 2-in., and 4-in. scale copies are enumerated in tabular form. *Author's summary.*

61.3 (931). ASCH, H. P. D. VAN, and WICKETT, H. C. **Discussion on aerial surveying in its relation to forest reconnaissance.** *N.Z. Jnl. For.* 4, 1938 (141–7).

The results of an aerial survey of a timber area at National Park, New Zealand, suggest the usefulness of the method for State forests and for private woodland sufficiently large to warrant the expenditure involved.

61.4. HUGERSHOFF, R. **Topographical surveys during tours.** *Kolonialforstliche Mitteilungen* 1, 1938 (75–80). [G.]

Methods of carrying out topographical surveys in the course of tours are discussed in general terms. The author constructed a portable watertight route registering instrument (Routenaufnahmegerät nach Hugershoff) consisting of a recording drum driven by clockwork, a compass, and a device by means of which the direction of travel is registered on the recording drum. All the carrier of the instrument has to do is to make an adjustment at every change of direction, and time and direction are automatically registered. The instrument is accurate to 0·5 minute and 5°.

66. MANTEL, W. **Surplus yield in theory and practice as related to forest management.** *Allg. F. & J.* 114, 1938 (246–54). [G.]

Methods are discussed of estimating the effect of cutting 50 per cent. in excess of increment, as is being done at present in Germany. The practical aim is to determine how long the present policy can be continued without reducing the possibility, in the period following over-cutting, below a certain percentage of the normal, and the length of time that will be required to repair the results of previous over-cutting. It is roughly estimated that, after 5 years of cutting at the present rate, the possibility will have to be reduced in most German forests to 85 per cent. of the original normal figure in order to restore the original forest capital within 15 years. The author also discusses the problems of management arising from the current policy.

66 : 12.26.22 (931). JANSON, R. W. G. **Thoughts on Silver Beech [*Nothofagus menziesii*] management.** *N.Z. Jnl. For.* 4, 1938 (138–41).

Advantages and possibilities of organizing sustained yield management of indigenous forests of Silver Beech (*Nothofagus menziesii*).

66 : 65 (94). Gray, H. R. **Crown ratio and irregular stocking.**—*Austral. For.* 3, 1938 (94–8). Use in estimating growing stock for the purpose of yield regulation.

The value of crown ratio as a guide in estimating approximately the normal growing stock, and the abnormality existing in natural uneven aged forests of eucalypts, is discussed. The method is considered useful in the early stages of management.

7. ECONOMICS. VALUATION. FINANCE. PROFIT AND LOSS

73 : 74. Hufnagl, L. **The economics of the theory of the highest rate of interest on soil capital value.** *Centralbl. f.d.g. Forstw.* 64, 1938 (173–81).

The theory of highest rate of interest on soil capital value is criticized as tending to decrease forest revenue. It is said to ignore the capital value of the growing stock and to be of no use in practical forest valuation.

76 (47.1). Saari, E. **The calculation of the annual financial returns of state-forest ranges and districts in Finland.** *Silva Fenn.* 46, 1938 (12–24 and 238). [Fi.g.]

Some simple modifications are suggested in the present system of accounting of the Finnish State Forest Service.

8. ADMINISTRATION

8 : 09.1 (47.1). Hertz, M. **The forest administration of Finland, 1859–1934.** *Act. For. Fenn.* 43, 1938 (1–172). [Fi.g.]

The author deals at length with the history of forest administration and of forestry in general in Finland from the first beginnings in the seventeenth century up to 1934. Forest administration proper began in the period 1859–70, but little progress was made and the State Forests were run at a loss. Two successive periods of expansion followed (1870–1902 and 1902–18) and the administrative service was expanded as the forests showed increasing profits. The last phase, from 1918 onwards, is that of Finnish national independence, and has been characterized by extensive reorganization and increased activity on all sides.

9. POLICY

90 (498). Dinu, V. **Post-war forest policy in Rumania.** *Deutscher Forstv. Jahresb.* 1937 (356–73). [G.]

The paper contains an outline of the post-war social history of Rumania in so far as it has affected forestry; a discussion of the main changes in Rumanian forest law before and after the War; and a description of the public institutions at present concerned with the various aspects of forestry, including administration, education, and research. In formulating the aims of Rumanian forest policy the importance of co-ordination and of State control over private woodlands is stressed.

90 (67.5). Tondeur, G. **On the position of the 'forestry question' in the Congo.** With special bibliography. *Bulletin Agricole du Congo Belge* 29, 1938 (65–123). [F.]

Although about 50 per cent. of the area of the Belgian Congo is covered with forest vegetation, the distribution of the forest is such that there is a fuel and timber famine in some parts of the country, while in others the forest is so abundant as to impede progress in agriculture and settlement. Since the native population has taken to growing commercial crops without taking any measures to compensate for the drain on soil fertility, extensive destruction of forest, followed by erosion and laterization, has become general in certain parts of the territory, particularly in the cotton-growing region of the Uele and the region of Ubangu. Exploitation of timber resources without sufficient regard for regeneration, as in the Mayumbe forest where 50,000 cubic metres are removed annually, is another cause of forest destruction. Amongst the principal measures of improvement suggested are silvicultural studies directed particularly to the natural and artificial regeneration of *Terminalia*

superba, *Chlorophora excelsa*, and valuable species like Ebony; improvement of native agricultural practice, e.g. by the large-scale introduction of fallowing with perennial legumes —a technique much less laborious than green manuring proper, which requires deep hoeing and could hardly be expected of the natives under present conditions; regulation of savanna burning; afforestation of certain areas to supply both native and European requirements; and so on. Hitherto, the species most successfully and widely employed in afforestation work have been eucalypts, but the belief is expressed that further experiments with indigenous trees should give just as favourable results. The paper contains a critical analysis of the existing forest law of the Congo and a history of the forest reserves in the Colony, with a list and map giving particulars of their constitution, situation, area, &c.

90 (68). WYK, J. H. VAN. **Forest policy in South Africa.** *Emp. For. Jnl.* 17, 1938 (44–50).

The indigenous forests of South Africa can supply only a very small fraction of the probable future needs of the country. The present policy is therefore largely concerned with afforestation in addition to the rehabilitation of the natural forests. Further important features of the forestry programme are the protection of catchment areas and the reclamation of drift sands. Valuable local industries are expected to develop as the forests extend, and already the Forest Department is helping to relieve unemployment among the poorer section of the white population by recruiting manual workers from that source as far as possible. The Department maintains two research branches for silvicultural and timber investigations respectively. Since 1932 a university course in forestry has been provided at Stellenbosch, while the personnel of the lower grades of the service receive training at a forest school near George.

92 (496). BÜK, F. **The new Turkish forest law.** *Rev. E. & F.* 76, 1938 (590–6). [F.]

This is a brief summary of the new Turkish forest law of 18th February 1937, which came into force on 1st June of the same year. It comprises the following main headings:—Definition of 'forest'. Division of forests into four categories:—State, communal, private, and those belonging to religious institutions. State control: all forests not belonging to the State are now under Government supervision. Settlement of boundaries. Cadastral survey and working plans: all private forest owners must prepare working plans within two years, after which the forest service may prepare plans at the expense of the proprietor. Firewood rights. Forest reserves. Utilization. Protection forests. Grazing. Afforestation: special measures are to be taken to develop a forest sense, such as courses of instruction in elementary and secondary schools and in the army. The fighting of forest fires. Penalties. Forests belonging to religious foundations. Measures for the period of transition.

92 (498). **New forest legislation in Rumania.** *Schweiz. Zeitschr. Forstw.* 89, 1938 (211–15).

An outline is given of the forestry position in Rumania, as a basis for the new legislation expected shortly. Of the 7·5 million hectares of forest which Rumania had at the end of the war, 1 million ha. were sacrificed before 1929, mainly as a result of the agrarian reform movement. Of the remaining 6·5 million 60 per cent. are administered by the State, although only 29 per cent. are actually government property. The total average annual increment is estimated at 18·6 million cubic metres. In the last 12 years the volume removed in fellings was 40–60 per cent. more than this increment; overcutting being particularly severe in conifers (which constitute 25 per cent. of the Rumanian forests) while hardwoods, and particularly Beech (forming 38 per cent. of the stock), were rather undercut. Since 15 million cu. m. of wood are consumed by the domestic market, curtailment of exports is suggested as a means of reducing forest destruction. It is considered satisfactory that the export of Beech firewood has increased in 1937 while that of sawn timber has declined.

93 (43). SPEER. **Forest rights and modern German forestry.** *Deutscher Forstv. Jahresb.* 1937 (189–207). [G.]

The history of forest rights in Germany is summarized; although many of these rights have been extinguished during the last 150 years, about 40 per cent. of the German State forest area is still subject to different rights, many of which, however, are of little importance. Forest rights are most widespread in Bavaria, where they apply to 70 per cent. of the State forest area. 90,000 cubic metres of timber and 770,000 of firewood are removed annually from the

German State forests by right-holders. There are minor servitudes such as rights to collect litter and pasture, the latter being important only in mountainous country. Communal forests are generally less burdened by rights than State forests and private woodland is for the most part entirely free of them. The necessity for economizing raw material has brought the question of forest rights into prominence in modern German forestry. The author advocates gradual extinction of all rights except those most vital to the local population (e.g. mountain pasture) and discusses the details of procedure to be adopted by the civil authorities in effecting this.

98.3 (59.1). GALLANT, M. N. **A new basis for royalty assessment on Teak in Burma.** *Emp. For. Jnl.* 17, 1938 (80–3).

Royalties were previously assessed on a fixed scale for the period of a lease, and this system worked well until the slump years. The Government now proposes to set up a scheme to ensure that the royalties due in any year are in proportion to the market value of round timber at the milling centre. A basic royalty rate is to be laid down and adjustments will be made in accordance with an index derived from the year's prices as recorded at the public auction sales of a Government agency which markets about 10 per cent. of the total Burmese output of Teak.

LIST OF ABBREVIATIONS

Act. For. Fenn.	Acta Forestalia Fennica. Helsinki.
Algeria Stn. Rech. For. Bull.	Algiers Station: Recherches Forestières du Nord de l'Afrique, Bulletins. Algiers.
Allg. F. & J.	Allgemeine Forst- und Jagd-Zeitung. Frankfurt.
Ann. Ec. Nat. E. & F. Nancy	Annales de l'École Nationale des Eaux et Forêts. Nancy.
Austral. Cw. For. Bull.	Australia Commonwealth Forestry Bureau Bulletins. Canberra.
Austral. For.	Australian Forestry. Perth, W.A.
Bull. agric. Congo Belge	Bulletin agricole du Congo Belge. Brussels.
Bull. cercle zool. congo.	Bulletin du Cercle zoologique Congolais. Ganda.
Bull. Com. For. Paris	Bulletin du Comité des Forêts. Paris.
Bull. S. Fr.-Comté	Bulletin de la Société forestière de Franche-Comté. Besançon.
Centralbl. f.d.g. Forstw.	Centralblatt für das gesamte Forstwesen. Vienna.
Deutscher Forstv. Jahresb.	Deutscher Forstverein. Jahresberichte. Berlin.
Emp. For. Jnl.	Empire Forestry Journal. London.
For. Chron.	Forestry Chronicle. Toronto.
Forst. Forsøgsv. Dan.	Det forstlige Forsøgsvaesen i Danmark. Copenhagen.
Forstw. Centralbl.	Forstwissenschaftliches Centralblatt. Berlin.
Ind. For.	Indian Forester. Lahore.
Inst. Rech. For. Poland Trav. & Comptes Rendus	Institut de Récherches des Forêts Domaniales: Traveaux et Comptes Rendus. Warsaw.
Jnl. Ecol.	Journal of Ecology. London.
Jnl. For.	Journal of Forestry. Washington.
Jnl. for. suisse	Journal forestier suisse. Berne.
Jnl. R.R.I. Mal.	Journal of the Rubber Research Institute of Malaya. Kuala Lumpur.
Jnl. S.A. For. Assn.	Journal of the South African Forestry Association. Pretoria.
Mal. For.	Malayan Forester. Kuala Lumpur.
Mitt. Forstwirt.	Mitteilungen aus der Forstwirtschaft und Forstwissenschaft. Hannover.
Mitt. Forstw. Abt. Tartu Estonia.	Mitteilungen der Forstwissenschaftlichen Abteilung der Universität Tartu. Tartu.
Mitt. Schw. Anst. forstl. Versuchsw.	Mitteilungen der Schweizerischen Anstalt für das forstliche Versuchswesen. Zürich.
N.Z. Jnl. For.	New Zealand Journal of Forestry. Wellington.
Philip. Jnl. For.	Philippines Journal of Forestry. Manila.
Queensland Agric. Jnl.	Queensland Agricultural Journal. Brisbane.
Rev. E. & F.	Revue des Eaux et Forêts. Paris.
Rev. int. prod. col.	Revue internationale des produits coloniaux. Paris.
Schweiz. Zeitschr. Forstw.	Schweizerische Zeitschrift für Forstwesen. Bern.
Scot. For. Jnl.	Scottish Forestry Journal. Edinburgh.
Silva Fenn.	Silva Fennica. Helsinki.
Sven. Sk. Tids.	Svenska Skogsvardsföreningens Tidskrift. Stockholm.
Thar. For. Jahrb.	Tharandter forstliches Jahrbuch. Berlin.
Trop. Agric.	Tropical Agriculture. Trinidad.
Trop. Woods	Tropical Woods. Yale, Newhaven, Conn.
Zeitschr. F. & J.	Zeitschrift für Forst- und Jagdwesen. Berlin.
Zeitschr. f. angew. Entom.	Zeitschrift für angewandte Entomologie. Berlin.
Zeitschr. f. Weltf.	Zeitschrift für Weltforstwirtschaft. Neudamm.